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THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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The Institute, always confining its attention to the international aspect of the various questions concerned, shall :

(a) collect, study, and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce, and the prices prevailing in the various markets ;

(b) communicate the above information as soon as possible to those interested ;

(c) indicate the wages paid for farm work ;

(d) record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and, if possible, any effective remedies ;

(e) study questions concerning agricultural co-operation, insurance, and credit from every point of view ; collect and publish information which might prove of value in the various countries for the organization of agricultural co-operation, insurance and credit ;

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (E.A.).

FIRST PART.
ORIGINAL ARTICLES

Wheat Production in Canada.

BY L. H. NEWMAN

Secretary of the Canadian Seed Growers' Association, Ottawa, Canada.

The production of wheat in Canada extends from the Pacific in the West to the far Atlantic in the East, a distance of 3 653 miles. Wheat is also grown from the southern boundary to as far north as Dawson City, in 64° N. Lat. It is not grown in commercial quantities, however, much north of 54° N. Lat. except in a few small localities.

Roughly speaking, the Dominion may be divided into six main sections in regard to its wheat production.

1. MARITIME PROVINCES: In the Maritime Provinces, which comprise the provinces of Prince Edward Island, Nova Scotia and New Brunswick wheat growing is carried on to a comparatively limited extent, there being approximately 62 000 acres in the three Provinces devoted to this crop. Practically all wheat produced belongs to the spring-sown varieties and is consumed at home. The varieties most commonly grown are White Russian, White Fife, Red Fife and Marquis. The quality of the wheat produced is not usually so good as is that of the wheat grown further west, a considerable proportion of kernels being starchy. This is particularly true of the White Russian wheat.

2. QUEBEC: Approximately 70 000 acres of lands are devoted to the raising of wheat in Quebec, the varieties most commonly grown being Red Fife, White Fife, Huron and Marquis. The wheat produced in this Province is often not quite so attractive as is that produced on the Western prairies, but when hard wheats such as Fife or Marquis are used, the quality is quite up to that of the Western grown grain.

3. ONTARIO: In Ontario, both spring sown and autumn sown varieties are used, the former being confined chiefly to the Eastern and Northern parts of the Province, while the latter are used almost exclusively in the

Western and Southern parts. In round numbers about 900 000 acres are devoted to the production of autumn wheat while only 120 000 produce spring sown sorts.

Autumn wheat in Ontario

The autumn varieties are usually sown in September. At the Ontario Agricultural College, Guelph, almost 300 varieties of autumn wheat and a large number of selections and crosses have been under experiment during the past twenty-five years. In 1915, seventy-six different lots of wheat were tested under uniform conditions. These included 39 named varieties, 23 hybrids and a number of selections. Of the named varieties, fourteen have been grown in each of the past nineteen years. The results obtained are as follows:

Variety	Colour of grain	Pounds per measured bus. (18 yrs.)	Yield per acre	
			Average 19 years	
			Tons straw	Bushels grain
Dawson's Golden Chaff.	White	60.0	2.9	51.1
Imperial Amber	Red	61.2	3.2	48.1
Early Genesee Giant.	White	60.1	3.0	46.5
Egyptian Amber.	Red	61.8	3.2	46.4
Early Red Clawson	Red	59.0	2.8	46.1
Rudy.	Red	61.6	2.7	45.0
Tasmania Red.	Red	61.9	2.9	44.4
Geneva.	Red	62.4	3.0	43.9
Tuscan Island.	Red	61.2	2.9	43.3
Kentucky Giant.	Red	61.3	2.8	43.2
Turkey Red.	Red	61.4	2.7	43.0
Treadwell.	White	60.1	2.8	41.7
Bulgarian.	White	60.7	2.8	41.5
McPherson.	Red	61.7	2.6	41.5

The variety most commonly grown throughout the Province is Dawson's Golden Chaff, which variety has held first place for a considerable number of years. This sort produces a very stiff straw of medium length. The heads are beardless with reddish chaff and white grain which usually weighs slightly over the standard per measured bushel. The quality of the grain has not been held in particularly high esteem by millers, although

* From Bulletin 228, "Farm Crops", Ontario Agricultural College, 1915, by Dr. C. A. Zavitz.

it is believed to be improving somewhat as years pass by. While certain other sorts are preferred by the miller, yet on account of the superior yield and stiffness of straw the producers still favour this sort.

Imperial Amber produces wheat of rather better quality but is not quite so productive nor so strong in the straw. The head is also bearded and therefore less popular.

A number of varieties other than those mentioned in the table have been tested during the past five years. Of these the most promising are Grand Prize, Kharkov, Yaroslaf and Crimean Red. These, in productiveness, rank in the order given, but none were quite equal to Dawson's. The varieties which have produced the heaviest weight of grain per measured bushel in the five years' test are Rudy, 62.4; Egyptian Amber 62; Geneva, 62.4.

In the average results of five years' test, the Yaroslaf was the freest and the variety known as the Abundance was the most severely affected by rust. Dawson's Golden Chaff was the earliest to mature, while the Yaroslaf and Banatka were the latest.

In each of the past seven years 24 varieties of autumn wheat have been carefully tested at the College for bread production. Those varieties which produce the largest loaves from equal quantities of flour on the average are as follows:

Banatka, Crimean Red, Yaroslaf, Tuscan Island, Tasmania Red, Egyptian Amber, Budapesth, Rudy, Treadwell, McPherson and Bulgarian.

New varieties of autumn wheat.

A considerable amount of work has been carried on at the College in recent years in attempting to produce improved sorts. Crosses have been made between Dawson's Golden Chaff and some of the varieties possessing particularly high qualities such as Crimean Red, Tasmania Red, Turkey Red and Imperial Amber. The most promising crosses at present are those obtained from the Dawson's Golden Chaff and the Tasmania Red, some of these excelling in yield any of the named varieties.

Spring Wheat in Ontario.

As already intimated, the production of spring wheat in Ontario does not occupy a specially important place. The varieties most commonly grown are Red Fife, and Marquis. White Russian, which occupies a prominent place in the Maritime Provinces, is not grown to any extent in Ontario.

A variety not mentioned above but which is grown to a considerable extent is known as Wild Goose. This sort belongs to the Durum species and is not used commonly for bread-making but rather for the manufacture of macaroni and for poultry-feeding.

4. MANITOBA AND SASKATCHEWAN: During the past twenty years the production of wheat in this section of Canada has increased enormously.

While wheat growing in this country dates back to the beginning of the seventeenth century, yet it was not until after the means of transportation in the newer parts of Western Canada had become greatly developed that any very substantial increase in production took place. In this region millions of acres of fertile prairie soil, rich in organic matter awaited the advent of the husbandman who hitherto had been practically debarred by the enormous distances. With the extension of the various lines of railway, however, these vast tracts became opened up and now we find towns and villages and enormous stretches of cultivated fields where formerly the buffalo roamed unmolested. In 1901 the area devoted to wheat production in the above two Provinces, namely Manitoba and Saskatchewan, was slightly over two million acres and this represented about one-half the total wheat producing area in the entire Dominion. In 1916 there were 11 000 000 acres devoted to the production of this grain in Manitoba and Saskatchewan. In all Canada there were about 13 000 000 acres under wheat. This area produced 220 367 000 bushels. The five year average, 1909-1913, is 204 711 000 bushels. In the bumper year, 1915, 426 746 600 bushels were realized. Practically all the wheat grown in Manitoba and Saskatchewan is sown in the spring, there being very little autumn wheat used. The varieties most commonly grown at present are Marquis and Red Fife.

5. ALBERTA: In Alberta there were 2 571 670 acres devoted to wheat production in 1916. Of this all but 42 238 acres were devoted to spring wheat, the remainder being occupied by autumn wheat. Autumn wheat growing is confined chiefly to the southern parts of the Province, not being grown to any extent north of Calgary. The most common varieties of autumn wheat grown in Alberta are Kharkov and Turkey Red. The spring wheats, Marquis and Red Fife are the varieties grown almost exclusively.

6. BRITISH COLUMBIA: In this Province wheat is grown only on a small scale, and is used almost entirely for home consumption. Both autumn and spring sown varieties are used. The yields realized are fairly good, as is also the quality.

Wheat Breeding Work.

Apart from the work which has been done at the Ontario Agricultural College, and which we have already described, practically all breeding work with wheat has been done at the Experimental Farm, Ottawa. When the Dominion Experimental Farms were first established, one of their first concerns was the production of varieties of wheat better suited to cope with the severe conditions of the great wheat growing areas of the West. The short summer of the prairies demand that the sorts grown be capable of maturing in time to avoid serious damage by early fall frosts. At the same time the high cost of transport to the great wheat consuming centres rendered it imperative to produce a particularly high priced wheat, namely a hard wheat. The settlers at the time found that Red Fife wheat was fairly satisfactory on the whole excepting in regard to the time which it required to reach maturity. Failure to mature before frost often resulted

in enormous losses, thereby rendering wheat-growing a more or less precarious occupation. The director of the Experimental Farms the late Dr Wm. Saunders, consequently undertook the task of producing an earlier maturing sort which might still possess the high milling qualities of Red Fife. Importations of many sorts from different countries were made and soon experiments in cross-breeding were begun. Red Fife was used as one of the parents in almost all of the crosses made.

None of the importations from other countries proved satisfactory in themselves although some were of great value in cross-breeding work. One of the most valuable is that known as Ladoga, a variety brought from Russia. This sort was rather inferior in quality but was from two to three weeks earlier in ripening than was Red Fife. Crosses made between these two sorts however proved exceedingly interesting and valuable, combining as they did to a considerable extent the high quality of the one with the early maturity of the other. Four of the most promising crosses were Preston, Stanley, Huron and Percy. These sorts soon became fairly widely distributed, especially in those districts which were most liable to suffer from early frost.

They were on the average from seven to ten days earlier than Red Fife, but were not usually regarded so favourably as was the latter, by the millers.

In 1903 Dr. CHAS. SAUNDERS became cerealist and immediately undertook to select the varieties obtained from the different crosses which had been effected up to that time. Hitherto the system of selection after crossing had not been so thorough as was now known to be necessary. This work produced good results effecting as it did a very decided improvement in the varieties mentioned. Many other promising crosses have also been made and of these the cross to which the name "Marquis" has been given stands out pre-eminent. The history of this cross is interesting. A few years before Dr. Charles Saunders took up the work a cross had been made between Red Fife and a wheat brought from India known as "Hard Red Calcutta". The product of this cross did not receive any special consideration until Dr. Saunders took up his work in re-selecting old crosses. It was not long however until the remarkable qualities of this cross became apparent and as time passed the value of the sort became more and more assured, in fact there is no wheat grown in Canada to-day which possesses so many desirable combinations of characters. It matures from four to twelve days before Red Fife and very often produces from ten to fifty per cent. greater yields. It has excellent milling qualities, producing a flour of good colour and high baking strength. On summer fallows where Red Fife is liable to lodge, Marquis usually stands erect. Owing to its early maturity it is not so badly affected by rust as are sorts which take longer to mature. For six successive years the highest award in International Competitions in America for the best hard wheat has been won by Marquis.

In addition to the other varieties mentioned above, there are now on hand at the Experimental Farm a very large number of promising sorts which have been produced from crosses made in more recent years. These

are being investigated with a view to finding, if possible, a sort which may mark a still further advance. The investigations conducted with wheat at the Experimental Farm have been greatly aided by the use of a small experimental flour mill and the development of scientific methods of determining baking strength.

The introduction of these earlier maturing sorts has resulted in extending the area of profitable wheat production, since these sorts can be grown fairly safely in districts where hitherto wheat growing was not considered advisable. Furthermore the use of early maturing sorts in districts where Red Fife already has given good results has permitted a better distribution of labour by lengthening the harvesting season.

Wheat Improvement by Selection.

While cross-breeding has been resorted to as a means of producing new combinations of characters which may mark the beginning of new and superior races, yet considerable improvement has been effected even in certain old varieties by selection; for example in Red Fife, a type which matures somewhat earlier than the mother sort, was isolated. To this selection the name of "Early Red Fife" was given. This sort, while resembling Red Fife in all essential particulars ripens earlier and possesses certain other minor points of difference. Unfortunately this sort has shown a rather high susceptibility to the attacks of rust and for that reason, in part at least, it has not been largely grown.

Selection by Members of the Canadian Seed Growers' Association.

It has been a common observation for many years that the wheat fields of Canada very often contain a variety of types, each differing from the other in points of considerable importance. Thus some types would mature much earlier than others; other types would possess a stronger straw than their neighbours; others again seemed more susceptible to rust and other diseases. Recognizing the difference in practical value between such types, a movement was started in 1900 which aimed to encourage a greater interest in the importance of using pure seed. The movement took the form of a competition which three years later resulted in the organization of the Canadian Seed Growers' Association. The members of this Association consist of farmers who are anxious to provide themselves with the best possible seed and who, to this end, agree to follow a certain system of selection under expert direction. At first it was not only thought to be possible to purify the variety by a process of continuous selection which would gradually eliminate the less valuable strains, but it was also believed to be quite within the range of human possibility to effect certain definite improvements in the strain.

By taking advantage of variations which seem to be in an advantageous direction, it was hoped that strains of superior value might gradually be built up. This idea has been considerably modified during recent years.

At the same time experience shows that ordinary "mass selection" is a potent means of at least maintaining a high degree of purity in improved stocks.

When the Association first took up its work there was practically no pure seed in the country. This made it necessary for each member to start with ordinary unimproved seed. The system adopted required that a selection of heads be made each year from the the mature crop in sufficient quantity to get enough clean seed to sow at least one quarter of an acre the following year.

From that quarter acre plot a similar selection had to be made for another plot the following year, and so on. Growers who have followed this system faithfully have produced strains which possess a high degree of purity and which are also exceedingly productive and decidedly outstanding in other respects. Thus in Red Fife wheat we have a strain produced by Dow Brothers, of Gilbert Plains, Manitoba which is outstanding in all practical qualities. These people have selected continuously for sixteen years according to the above system. Banner oats, produced by the same growers after many years of careful selection also occupies first rank among the hundreds of oats varieties grown in Canada. Another strain of Banner oats which is particularly noteworthy on account of its high industrial qualities is that produced by Thomas Waugh of North Bedeque, P. E. I. Between these two points, separated as they are by enormous distances, are to be found many members of the Association who have done creditable work by simple mass selection. As time passes the value of this sort of systematic work by farmers themselves on their own farms is repeatedly emphasized. In Western Canada the growers of Marquis wheat are confronted with the problem of maintaining purity and uniformity in this now famous wheat.

This problem is one which is worthy of the best efforts of all concerned, but it is only by some sort of organized effort such as that fostered and encouraged by the Canadian Seed Growers' Association, that it may be accomplished.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

617 - Observations on Certain Flies Infecting Meat or Causing Human Myiasis.

DEKLER, GUSTAV, in *Zeitschrift für Fleisch- und Milchhygiene*, Year 27, Part 3, pp. 35-38; Part 4, pp. 52-54; Part 5, pp. 68-71, Berlin, Nov. 1 and 15, and Dec. 1, 1916.

The writer has visited two of the biggest meat markets in Vienna and has carried out observations on the live adults, eggs, larvae, pupae, etc. of flies which visit meat. The flies were captured by means of a special apparatus at the moment of alighting on the meat. In order to obtain the larvae, various pieces of meat were exposed on the roof of the market. After the flies had deposited their eggs, the pieces were removed to the laboratory in order to allow the eggs to hatch. Altogether, some 10 000 flies were caught and 98 larvae obtained in the laboratory.

The following are the conclusions derived from these observations:

1) Flies prefer, both for egg-laying and feeding, fresh meat at a temperature of at least 17°C. Chilled or frozen meat is avoided by them.

2) The eggs are laid for preference in those portions of the meat which are fairly damp, warm and not directly exposed to sunlight: abdominal cavity, lower part of back, muscle folds, etc.

3) The species most frequently occurring on meat are: *Lucilia sericata* Meig., -- *Calliphora erythrocephala* Meig., -- *Sarcophaga haemorrhoidalis* Meig., -- *S. nigrus* Rond. -- *S. calcidaria* Panfollé, -- *Phormia groenlandica* Zett. -- *Muscina stabulans* Fall. -- *Fannia canicularis* and *F. scalaris* L. The following rarely occur on meat: *Ophyra leucostoma* Wiedem. and *Drosophila funebris* Fabr.; they feed on it but never oviposit. The same thing holds for *Musca domestica* -- *Calliphora vomitoria* -- *Sarcophaga carnaria* -- *Musca meridiana* and *Shomyia calcitrans*.

4) The presence of the larvae of these flies affords no evidence as to whether the meat is putrid or not.

- 5) The dimensions of the larvae can only be determined with precision after they have been killed; the size is practically of no use for determining the length of infection.
- 6) If the infected meat is exposed to a temperature of 10°C. the process of hatching is arrested and the eggs gradually die off.
- 7) The larvae die if exposed to direct sunlight or if the medium in which they occur becomes dry.
- 8) A temperature of below 7°C. arrests the development of the larvae but does not kill them. The optimum growth temperature is between 20° and 40° C. The larva pupates on the 5th. or 6th. day after hatching, both at the above temperatures or at a temperature of 15° to 27° C.
- 9) Meat containing larvae can be dangerous to man if eaten raw.
- 10) No effective method is yet known for protecting meat from becoming infested with flies. At present, the best way is to keep the meat in a cool, dark place. The larvae are not killed either by washing the meat with vinegar or a solution of potassium permanganate, or even by immersing the meat in these two liquids.

618 - The Station for Forestry Research in Denmark. — *Det Forstlige Forsøgsvesen i Danmark*, Vol. IV, Part 4, pp. 461-463. Copenhagen, 1915 (1).

In 1883, there was established in Denmark a Section for research in forestry, as a branch of the Office for the Management of State Forests. This arrangement continued down to 1901 when the Minister of Agriculture organised the Station for Forestry Research.

The management is in the hands of a chief of Station, in conjunction with a commission of 2 representatives of the Forest Administration — 2 representatives of private silviculture — 1 representative of forestry instruction. The members of the Commission are nominated by the Ministry of Agriculture except those representing private silviculture who, in the first instance, are proposed by the Directing Council of the Forestry Society. The Chief of Station is a permanent member of the Commission and acts as president; he also acts as editor and is responsible for the accounts. With regard to the other members of the Commission, one member must be re-elected every two years.

The Commission meets once yearly at least. It settles the plan of work for the coming session and draws up the budget. It reports upon the work of the preceding session. It has the power to entrust the direction or execution of a piece of work to a person other than the Station Chief, although in cases where the nature of the work demands continuity it shall be the Station Chief who has preference. The Commission may consult technical men and invite them, if necessary, to attend their sittings, in cases where they are deemed specially competent to deal with some special question.

The Station expenses for the period 1902 to 1915 have increased from 11 530 to 19 450 francs distributed as follows:

- 1) Sittings of Commission; 2) Payment of 4 members of the Commission; 3) Payment of Chief of Station; 4) Payment of other persons conducting experiments; 5) Salary of assistant;

(1) See A. O., *Forsøgsvesenets Ledselse*, *Ibid.*, pp. 445-457 + 3 figs.

(Ed.).

6) Daily pay and travelling expenses of Chief of Station; 7) Daily pay and travelling expenses of assistant; 8) Experiment grounds (regular); 9) Hegelund nursery; 10) Other trials conducted by Station Chief; 11) Other trials conducted by special men; 12) Postage, carriage, servants etc.; 13) Apparatus, books, office clerks etc.; 14) Publication of reports.

The Station for Forestry Research now has its office at Copenhagen, near the Higher School of Agriculture, and its Experimental Nursery (13½ acres) at Hegelund, 35 kilometres from Copenhagen. This latter possesses a little wooden building containing the workmen's quarters and an office.

Up to the present, the Station has published 4 volumes (1905-1915) of reports. Beginning with the 4th. volume the reports, printed in Danish, are accompanied by summaries in English, French and German. The following is a list of subjects dealt with up to the present.

Growth and yield of forest trees — Trials of foreign species — Researches on forest soils and particularly the forms of humus and soil biology — Mechanical and chemical analyses combined with trials on the application of artificial fertilisers to spruce, Scots pine, fir and oak in heath soils — The action of storms on forest trees — Races and forms of forest trees — Control of diseases of forest trees — Management, thinning and repopulating of beech — Manufacture and employment of wood for joinery and fuel — Easy and economic methods of measurement of timber.

In view of future researches on the natural conditions of forests, the Station occasionally takes measures for the enclosure of single trees, of groups of trees and sometimes of large areas of wood.

Since 1902, the Station has belonged to the international organisation of Stations for forestry research, and has been represented at the meetings at Vienna (1903), Würtemberg (1906) and Brussels (1910).

CROPS AND CULTIVATION.

619 — A Review of Investigations in Soil Protozoa and Soil Sterilization. — KOPELOFF, N. and COLEMAN, D. A. In *Soil Science*, Vol. III, No. 3, pp. 197-269. New Brunswick, N. J., March 1917 (1).

As there has been no adequate historical review of the literature dealing with soil sterilization and soil protozoology, with the exception of certain introductory briefs published in connection with investigations along one definite line or another, the writers considered it advisable to present a survey of the subject to date, not only as an introduction to the investigations to follow, but likewise as being of inherent value to the investigator pursuing specialized work along these and allied lines, and those whose interests may lead them into the field of soil fertility. The practice of

(1) See B. May 1917 and *passim*.

sterilizing soils by heat, as well as antiseptics, has been the basis of no small amount of experimentation before the publication of Russell and Hutchinson's work. However, in view of the importance of the latter, it seemed to the writers desirable arbitrarily to divide the investigations into sterilization into two parts, the first treating of those prior to Russell and Hutchinson, and the second of those following. Again for the purpose of a more coherent résumé, soil sterilization may be considered under the two headings of sterilization by heat, and antiseptics, each of which may be further subdivided into three parts, namely: (a) the effect on the physical and chemical condition of the soil; (b) the effect on plant growth; (c) the effect on the biological activities.

From the review of the bulk of the literature dealing with soil protozoa and soil sterilization, it may be seen that, despite the work already done, comparatively little is known concerning the phenomena involved. Tracing the practice of soil sterilization by heat and disinfectants it is seen that beyond recognizing the fact that crops are increased by such treatment, and that the chemical composition of the soil undergoes an alteration, together with a profound influence on the biological activities, data of a definite and penetrating character are wanting. Among the varied theories advanced to explain the phenomena of soil sterilization briefly summarised in this paper the following demand serious consideration:

1. In KOCH's theory of direct stimulation it is maintained that increased crop production is a result of the physiological effect of the sterilizing agency in stimulating plant growth directly. While several investigators have confirmed Koch's conclusions, they are nevertheless not widely accepted at the present day.

2. HILTNER and STORWER's theory of "indirect" stimulation emphasizes the bacterial factor. These investigators maintain that there is a bacterial equilibrium in the soil which is altered by the introduction of sterilizing agencies. After the decimation of a vast number of bacteria has occurred, a marked development in numbers ensues, which is responsible for the additional available plant-food causing an increased crop yield. This theory has received the confirmation of many eminent investigators, and is still in vogue, although it hardly completely explains the phenomena observed.

3. LIERSCHER's view is that soil sterilization may be regarded in the same light as a nitrogenous fertilizer. This is not worked out in very great detail, but finds corroboration in most subsequent investigations.

4. RUSSELL and HUTCHINSON's conclusions have been considered at some length and have been so frequently referred to that it suffices to say at this point that they contend that sterilization eliminates a biological factor (protozoa) which is one of the limiting factors in soil fertility. This view, although having a profound influence upon all research in this field, has not been accepted by the majority of investigators working along the same lines.

5. PICKERING attaches the utmost significance to an alteration in

the chemical composition of the soil and proves that this change is largely responsible for increased plant growth.

6. SCHREINER and his associates also emphasize the chemical aspect of the problem, and contend that biochemical factors induce a change in the organic matter of the soil, releasing certain beneficial and harmful compounds which change the fertility of the soil.

7. GREIG-SMITH and others adhere to the bacterio-toxin hypothesis which considers that toxins and nutrients of the soil are alone concerned with the changes that occur when soils undergo sterilization. In his latest paper GREIG-SMITH contends that the traces of antiseptic remaining in the soil are responsible for increase in bacterial numbers and activities.

It remains unquestionable that considerably more investigation must be carried out before any one of the above theories is accepted in an unqualified manner. Considering the province of soil protozoology in its entirety, it immediately becomes apparent that this science is in its infancy and is urgently in need of suitable methods for making accurate investigation possible. As media, 1 per cent hay infusion, 3 per cent blood meal solution and soil extracts have proved to be most generally accepted. In staining, picric acid (KLEINENBERG) and iron haemotoxylin (DELAFIELD'S) are most highly recommended. The "Blutkörperzählapparat" and the loop methods are employed for counting. A consideration of the inter-relation of protozoa and bacteria in normal soil remains practically a virgin field, although what little evidence there is obtainable points to the probability that the protozoa limit bacterial activity under conditions especially favorable to protozoan development. Thus, the scope of unsolved problems is considerably broader than the investigations already carried to completion. How to sterilize the soil without altering its chemical composition is an important though baffling problem.

On the bacteriological side much can and needs to be done in determining the differences in the physiological efficiencies of the various groups of organisms in the soil and how they are affected by sterilization. Further, it is imperative to know what rôle the fungi play in soil fertility, and how they may be taken into consideration when it is desired to have bacteria or protozoa constitute the limiting factor. In addition to an improvement and discovery of methods in soil protozoology it is essential to know more of the life-habits of these organisms, especially as regards the effect upon them of environmental conditions such as (a) the physical and chemical conditions in the soil, together with the effect of (b) air; (c) light; (d) heat; (e) moisture, reaction, gases, etc., as well as the mutual association with other biological factors. Finally, a matter demanding immediate study is the actual observation of pure cultures of protozoa acting singly and collectively upon pure cultures of bacteria, thus furnishing some definite basis for the investigation of soil protozoa as a factor in soil fertility.

its place with soil bacteriology as furnishing a portion of the foundation essential for soil fertility investigations.

A list of 337 references to literature bearing on the subject is given in appendix.

- 620 - **The Relation of Protozoa to Certain Groups of Soil Bacteria.** — HILLS, T. L. (Laboratory of Agricultural Bacteriology, University of Wisconsin) in *Journal of Bacteriology*, Vol. I, No. 4, pp. 423-433 Baltimore, 1916.

The writer has studied the effect of protozoa on certain biological processes of the soil: ammonification, nitrification, and free nitrogen fixation. For this study silt loam soil cultures were used; the moisture content was maintained at as near one-half saturation as possible.

In the soil cultures the presence of protozoa under the conditions of the experiments did not have any noticeable effect, detrimental or otherwise, on the processes of ammonification, nitrification and free nitrogen fixation. In the case of the liquid cultures employed in the study of free nitrogen fixation the conditions were at an optimum for the development of the protozoa and under these circumstances they limited bacterial activity as evidenced by the harmful effect on the fixation of free nitrogen. Under these conditions the protozoa were undoubtedly active in destroying the *Azotobacter* cells. But in the soil cultures conditions were evidently not favorable for the activity of the protozoa as these organisms did not appear to exert any harmful influence on the three soil processes studied.

A bibliography of 6 references is appended.

- 621 - **New Irrigation-District Code for Oregon, U. S. A.** — CUPPER, PERCY A. in *Engineering News-Record*, Vol. 78, No. 5, p. 254. New York, May 3, 1917.

The Oregon legislature has just enacted a complete irrigation-district code and repealed all laws on this subject hitherto existing in the statute books.

Under the new code the organization of the district, which is a quasi-municipal corporation, is initiated by filing a petition with the County Court. If the Court approves, an election is called, landowners voting.

The district is governed by a board of 3 directors. The state engineer is required to approve or disapprove the plans prepared by a competent engineer appointed by the Board of Directors or plans adopted by the Board. Final payment to any contractor constructing the irrigation district works shall not be made until the constructed works have been approved by the state engineer.

Bonds of the irrigation district bearing not over 6 % interest may be issued to cover the cost of construction. The funds necessary for the payment of the expenses of the district, including the interest and principal on bonds, are raised by assessment on the lands according to benefits, levied in the same manner as state and county taxes are levied and collected by the county officials.

The issue of bonds is subject to the authorization of the Attorney General, the state engineer and the superintendent of banks, who must first

be convinced that the value of the property to be irrigated and that of the irrigation works is equivalent to at least twice the amount of bonds issued.

622 - Summary of Researches by Messrs. MÜNTZ and LAINÉ on the Control of Irrigation according to the Physical Properties of Soils. — HATIER, H. in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, 116th. year, 1st. half year, Vol. 127, No. 2, pp. 386-398. Paris, March-April 1917.

From 1905 to 1910 Messrs. MÜNTZ and LAINÉ were engaged upon a series of researches, conducted both in laboratory and field in various parts of France, on the capacity of soils to utilise irrigation water and the most favourable conditions of distribution of this water.

The writer points out the value of such a study and the importance of knowing how best to use and to draw the maximum amount of profit from the invariably limited amount of irrigation water. Unfortunately, death has interrupted the course of the work. The results already obtained, however, are of great importance and it is to be hoped that others will carry on the research.

Messrs. MÜNTZ and LAINÉ have shown that it is indispensable to include, among the preliminary plans of an irrigation scheme, a study of the physical properties and particularly of the permeability of the soils contained in the irrigation area. They have shown that, contrary to generally received opinion, soils even of similar geological formation show enormous differences among themselves in this respect. They conclude the account of their 1905 to 1907 experiments in the following manner:

Apparently, soils can be divided into 3 categories:

- 1) those which can be regarded as almost impermeable, that is to say in which the water only penetrates a few millimetres in an hour and which, consequently, are not capable of allowing water to penetrate in ordinary irrigation conditions. In the authors' opinion, therefore, these soils are only worth irrigation in quite special economic and technical conditions.
- 2) slightly permeable soils, which the water, in the ordinary conditions of practical irrigation, can penetrate at about the rate of 1 cm. per hour and which would be suited by light irrigations repeated more or less often.
- 3) soils which the water penetrates to a depth of a few centimetres or more and which may be regarded as permeable, that is to say readily absorbing water and meriting heavier irrigation. Above a certain degree of permeability there is no longer any object in determining the exact degree to which the soils belong in the scale. Such soils are all capable of absorbing sufficient water. At this point there intervenes the determination of the amount of water actually useful to vegetation in order that it should be just this amount which is administered and not the undoubtedly greater quantity that such soils are capable of absorbing.

After 1908, Messrs. MÜNTZ and LAINÉ gave their researches another trend, devoting their chief attention to organising irrigation tests in different localities and in different classes of soils in order to discover the method of irrigation which gives the best effect on the crops.

Practical value of such researches. — The experiments made in the district of the Bourne Channel (Department of the Isère) show the practical scope of such researches. The Bourne channel, the Bourne being a tributary of the Isère, waters the plain situated on the left bank of the Rhône, to the south of the junction of this river and the Isère. The soils of this region are extremely permeable. According to the scale of Messrs. MÜNTZ and LAINÉ (1) this permeability varies from 30 to over 150, whilst soils of average permeability have an index varying from 5 to 20.

The water is led on to the land through narrow trenches which are dammed in order to make them overflow. When, as in the case in question, the permeability is very great, the process of infiltration is extremely rapid and unless the overflow is of considerable volume it only reaches the points closest to the trench. It then happens that a portion of the plots derives no benefit from the irrigation, whilst the soil near the trench is washed out by an excess of water; the soluble fertilising elements are carried off into the subsoil and are lost to the plants, whence the paradoxical result: the irrigation diminishes the fertility.

Further, the head of water supplied to the user at the highest point of his property is too small for the canal in question, with the result that in view of the permeability of the soil, the speed of the water is insufficient to allow of its reaching points any great distance away. The water is also too clear to allow of the permeability being diminished by means of the deposit of matter in suspension.

Good results may be obtained from the irrigation, however, if, in spite of the small water supply, sufficient rapidity can be imparted to the flood water to allow of the plot's if shortened, receiving water over its whole surface without the land around the supply trench receiving an excess.

Permeability of soils and their capacity to benefit by irrigation. — The best results have invariably been obtained in soils of average permeability.

When contemplating an irrigation project, a study of the physical properties of the soil is absolutely indispensable and it is particularly necessary also to determine the quantity of water permeating in a given time.

When this is done, soils may be classed in two great categories:

1) those possessing a degree of permeability corresponding to the two extremes of the scale; these extremes forming exceptions though occurring fairly frequently;

2) soils of average permeability.

In these latter, irrigations regulated according to the degree of permeability give remunerative results, that is to say barring exceptions independent of the nature of the soil.

In the case of the former, on the contrary, success is uncertain and before proceeding with the project it must be first considered whether the increase in yield is likely to be such as to compensate for the expense, which may necessarily be considerable. In soils of low permeability, in which the

(1) Each degree of the scale constructed by Messrs. Muntz and Lainé corresponds to a 1 cm. layer of water permeating in an hour.

water penetrates at the rate of 1 to 2 mm. per hour, it may be advisable to anticipate a careful arrangement of the land: regular slopes with sufficient drop which would not allow any surplus water to remain on the land, and sometimes even draining. In highly permeable soils in which the water penetrates at the rate of more than 40 to 60 cm. per hour, expenses may be equally high, especially with exaggerated wages to labour.

With these extreme types of land, when channels already exist it is advisable to turn them to account as much as possible.

In the case of very permeable soils a big volume of water is required at the head, the rapidity of the irrigating water being increased and the land divided into plots of small area.

For soils classed at the other end of the scale, the pressure of water at the head should be just sufficient, thus allowing the section of the laterals to be reduced; the speed of the irrigation water should then be reduced and the length of the plots increased.

General results of 1908, 1909 and 1910 experiments. — The quantity of water supplied by the irrigation is expressed by what is known as the *débit continu* (continuous supply). This is the volume of water given during the growing period related to an area of 1 hectare (2.4711 acres) and a time-period of 1 second.

The *débit continu* is the resultant of 3 dimensions:

- 1) The pressure at which the water is supplied to the plot by the ultimate branchings of the channel.
- 2) The duration of each irrigation.
- 3) The period elapsing till the next irrigation.

The experiments of Messrs. MÜNTZ and LAINÉ were conducted in order to fix these data. They were only concerned with natural meadowland irrigated by the flooding method. The experimental fields varied as widely as possible both as regards nature and permeability of soil. Both the volume of water and the intervals between irrigations were made to vary and the influence of such variations on the crop yield determined.

The experimental fields were classed as follows according to the authors' own scale:

	Permeability
Fourcaudet	0.5 to 0.1
Onès	0.6
Cheval-blanc (near Cavaillon)	2.0
Pernes-Garrigue	3.0
Carpentras } Carpentras-Terradou	10.0
Hernes-Croix-Couverte	12.0
Valence	50 to 60

The following data were determined in each field:

- 1) the "module" or head of water at highest point of property;
- 2) the quantity of water which had the most favourable effect upon the crop yield, with irrigations at identical intervals;

3) The influence on the yield of a same total quantity of water distributed in smaller or greater amounts at more or less frequent intervals.

I. *The "Module".* — The "module" (head of water at highest point of property) is equal to the product of the volume of the flood water and the width of the plot to be flooded.

The volume and speed of the flood water should vary between wide limits according to the rapidity with which the water penetrates, and should increase with the increase of this latter. The experiments have shown that, in very slightly permeable soils, like those of Fourcadel or Ondes for example, the "module" should be such that the capacity of the irrigation flood should be about 0.30 of a litre per metre of width per second; in soils of average permeability, as at Carpentras, it should be equivalent to a capacity of 1.5 to 2 litres per metre, per second; in lands of extreme permeability, such as those watered by the Bourne channel, it should exceed 9 litres per metre, per second.

In order to water more rapidly and to diminish labour the beds should be given the maximum width, still this width must not be exaggerated, otherwise it will make regular distribution of the water difficult.

II. *Quantity of water to be distributed at each flooding.* — The trials have shown that the amount of water to be employed should be just sufficient to allow of its reaching the extremity of the bed.

A quantity of water in excess of this represents a loss and might be employed for watering other surfaces; it might also be actually harmful owing to its washing out the soil and carrying off nutrient matter. If, in some cases, more plentiful watering gives a slight increase in the crop yield, this increase is not proportional to the extra cost of the water.

III. *Intervals between floodings.* — Generally speaking, the best results are obtained with irrigations repeated every 7 or 8 days.

Floodings at very close intervals often give an increased crop but this increase is neither sufficiently uniform nor important to compensate for the extra cost of labour.

Floodings at intervals of a fortnight and, especially of 3 weeks, give markedly inferior results.

Water supply. — Hitherto it has been held that the normal supply should be equivalent to 1 litre per hectare per second, for all lands. Messrs. MÜNTZ and LAINÉ have now found that, varying with the nature of the land, the correct supply should be as follows:

Fourcadel	0.23 litres instead of 0.75 litres as fixed by agreement
Ondes	0.54 " " 0.75 " not fixed
Cavaillon	0.55 " " 0.75 " not fixed
Carpentras	0.71 to 0.85 " 1.275 " as fixed by agreement

This proves that wastage usually occurs.

Messrs. MÜNTZ and LAINÉ add that the ideal irrigation would be one which supplied the soil with the quantity of water strictly necessary to obtain a maximum crop. In experiments at the Meudon Station of Plant

Chemistry, the amount of water evaporated which corresponds to 1 kg. of dry crop, never exceeded 550 litres. According to this, there would be required for the plus crop values obtained by irrigation, the following quantities of water.

	Plus-value of crop	Quantity of water	
		evaporated by the crop, cubic metres	usually given, cubic metres
Stations { Fourcadel	2 700	1 435	5 880
Andes	3 500	1 925	3 500
Carpentras	10 000	5 500	20 700

The quantities usually given are consequently greatly exaggerated. One must take into account, however, that an irrigation channel must respond to the calls made upon it at times of greater drought. If a fresh calculation is made for a second crop (aftermath) during a similar period, the following figures are obtained :

	Plus value furnished by the irrigation kg.	Number of floodings	Volume of water per flooding	
			usually given, cubic metres	utilised by the plant, cubic metres
Stations { Fourcadel	2 200	6	470	202
Ondes	2 225	4	500	306
Carpentras	4 330	8	830	208

These data, though of a somewhat abstract character, show that the real water requirements are markedly exceeded in practice. Although it is impossible to obtain the ideal quantity in practice nevertheless efforts should be made to approximate to it.

623 - **A Modified Method of Green-Manuring.** — HUTCHINSON, C. M. (Imperial Agricultural Bacteriologist) in *Bulletin No. 63, Agricultural Research Institute, Pusa*, 12 pp. Calcutta 1916.

It has been noticed that the complete decomposition of a green crop depends upon the incidence of rainfall following its burial. This fact has suggested the avoidance of negative results from green-manuring by carrying out the initial stages of decomposition under artificial conditions.

It has been found that the most complete breaking down of plant tissues was obtained by providing an excess of moisture accompanied by anaerobic conditions during the first stage, followed by a second one of less moisture and semi-aerobic conditions. The main object is to cultivate conditions favourable to the development of the class of organism whose specific function is the breaking down of the cellulose walls and middle lamella and whose absence in aerobic conditions indefinitely prolongs decomposition.

An example of such conditions is afforded in connection with the indigo industry. During extraction of the indigo in the factory the plant is partly fermented in water and partly in heaps after removal from the vat. The resulting product is a partly decomposed mass of vegetable tissue which possesses high manurial value. When this is taken directly to the land the greatest effect is not seen until the following season, whereas when allowed to remain in heaps for a further period of several months its action is rapid and immediate. Obviously, any green crops will give comparable results when so treated in proportion to their relative nitrogen content. Apart from the provision of nitrogenous food, however, the production of humus is also important so that it may pay to treat crops of low nitrogen content in the same way.

The following is an account of the method used by the writer but he wishes to lay down no hard and fast rules. Obviously, modifications can be introduced to suit local conditions. His principal object is to invite criticism and suggestions.

The method. — Borrow pits were dug at the sides of the field previous to cutting the green crop, this being done during the rains, the pits filled with water; the cut crop (*Crotolaria juncea*) was placed in the pits, left there for periods varied experimentally from 24 to 48 hours, removed from the pits, stacked in heaps and allowed to ferment for varying periods of time, after which the rotted manure was applied to the soil (1).

It was at first found necessary to water the heaps occasionally to avoid drying out, but this was subsequently avoided by plastering their outside with clay, comparatively small quantities of water being occasionally applied to prevent cracking of the latter.

Further modifications of this method were adopted subsequently; in order to avoid loss of nitrogen as ammonia, the water remaining in the pits was dug out and made into alternate layers with the green manure in the heaps. As large quantities of ammonia pass into the water during fermentation the smallest possible quantity of water should be used so as to make it possible to utilize the whole of it for moistening the heaps.

It was found that more complete fermentation could be obtained by inoculating the heaps with impure cultures of cellulose destroying bacteria obtained simply by making a water extract of fresh cowdung.

Manurial experiments with Sann hemp (*Crotolaria juncea*) fermented in this manner have been made upon the oat and tobacco crops and have given very favourable results.

The advantages of the method may be summarised as follows:

- 1) In case of the failure of the autumn rains and consequent lack of moisture in the soil the manure can be held over till the following crop.
- 2) The improved method of rotting the manure will enable the

(1) Later experiments seem to show the advisability of omitting the preliminary steeping in water (owing to loss of nitrogen) and of commencing the preparation of the fermented manure by stacking in heaps, moistening with water, and allowing fermentation to proceed as before.
(Author's note).

grower to postpone the cutting of the crop and thus obtain a much larger bulk of manure.

3) The possibility of applying larger and consequently more paying quantities of the manure per acre.

4) The application of the manure in a better digested form will increase the amount of available plant food at an early stage of growth of the succeeding crop.

The method should also be capable of application to the decomposition of the residues of other crops: stools of sugarcane for instance. These stools contain a considerable amount of saccharine matter and should form an excellent medium for bacteria.

624 - **The Trade in Nitrogenous Materials.** — I. BERTRAND A. (Inspector Fiscal de la Propaganda Salitrera), Industria y Comercio de substancias azoadas, in *Anexo al Boletín No. 8 de la Asociación Salitrera de Propaganda* pp. I-XV + 1-155. Santiago-Valparaíso, 1915. — II. IDEM, Una presentación grafica de la Historia Económica del Salitre en los últimos veinte años, in *Asociación salitrera de Propaganda, Circular Trimestral No. LXVII* (Boletín No. 8) pp. 3-5 + diagrams, Valparaíso, October 1915. — III. IDEM, Factores del Futuro Mercado Salitrero, *Ibid.*, No. LXVII (Boletín No. 10), pp. 180-187, December 1915. — IV. IDEM, Nuevas previsiones acerca de las condiciones económicas de Producción de la Salitre de Chile y demás substancias Azoadas, *Ibid.*, No. LXVIII, pp. 68-84, March 1916. — V. IDEM, Extension, Riqueza y Duración Augurada a los Yacimientos Salitreros de Chile, *Ibid.*, No. LXX, pp. 22-28, July 1916. — VI. IDEM, Conferencia dictada en la Semana de la América Latina en Lyon, el 4 de Diciembre de 1916 *Ibid.*, No. LXXI, pp. VI-XV, December 1916.

I. — In his continuation of the series of memoirs (29) already published dealing with the various aspects of nitrogen, the writer now deals with the subject as it appears in the light of new discoveries and international events. The 1st. chapter summarises the chief nitrogenous substances, their methods of application and the industries which may be practically regarded as deriving therefrom.

On examining the nitrate of soda industry in Chili, one sees that the average price at the factory, in September 1914, was 8.80 francs per 100 kilograms, equivalent to 0.60 fr. per kilogram of nitrogen. The number of factories in operation at the same time was 166, distributed irregularly over an area of 2 317 sq. miles, and their annual production capacity was 2 000 to 125 000 metric tons, the maximum production being capable of reaching 50 000 to 100 000 tons, which means the total amount available over 15 years was 800 000 to 1 500 000 tons. The costs of working a nitrate deposit are estimated at 26 to 52 fr. per ton.

The actual value of the nitrate deposits now being worked in Chili without reckoning depreciations, is 175 000 000 fr. The total capital concerned, not only in the deposits but also in the industry itself with its various branches, may be estimated at 750 000 000 to 950 000 000 fr.

The export value, 2 500 000 tons at 8.80 fr. f.o.b. per Spanish quintal (46.02 kg.) is equivalent to more than half the capital engaged. In this connection, however, it must be remembered that in 15 years the deposits of nitrate of soda may be exhausted. Of the capital engaged about $\frac{1}{3}$

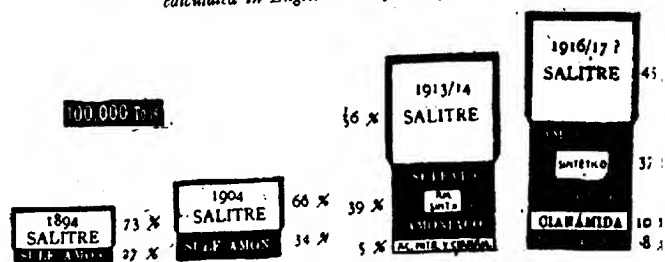
is Chilean, $\frac{1}{2}$ English, and the remainder is divided among Germany and other countries; the English companies, which are the most important, have paid annual dividends varying from 8 to 20 %. Since 1883, the Chilean Government has collected, in the form of a tax on export, a total of 2 750 000 000 fr. and, since 1903, the concession dues have brought the Government in another 75 000 000 fr.

The trade in nitrate being an overseas one with remote markets, it depends: a) on variations in the price of freights, this being accentuated by the fact that the producing country has no mercantile fleet of its own; b) on the fact that, once the product has left the country, the conditions of sale are no longer within the influence of the producers; c) on the fact that payments are made drafts on London, viz: in a medium which is not that of the producing country, thus introducing an element of speculation and unrest. Another cause of instability is the fact that, in the Northern Hemisphere, nitrate of soda is employed chiefly as a spring fertiliser, which results in $\frac{3}{4}$ of the amount exported to Europe being consumed in 4 months, while in the 5 months from July to November only $\frac{1}{4}$, or $\frac{1}{5}$, is consumed; on the other hand, the production must be continuous and uniform: whence a constant increase of stock in hand, aggravated by the difficulty of keeping the nitrate, and fresh ground for speculation. The result is that the nitrate of soda from the time of its leaving Chili till its arrival in the hands of the farmers who use it increases in price over 100 %, and this without taking into account a fluctuation of 10 to 15 % due to speculation. And while the producers' organisation, by means of propaganda, has aroused the demand for nitrate of soda, it has left to others the task of satisfying this demand.

The writer next examines the following industries: ammonium sulphate derived from coal — nitric acid (electric arc) and its derivatives — calcium cyanamide — synthetic ammonia — nitrification of aluminium — other processes (OSTWALD, HAUSER, BENDER, WOLTERECK, MOND) of electric oxidation and of synthesis of ammonia. On examining the degree of competition among the various products it results that the strongest competitor of Chilean nitrate will be the German output of nitrogenous material, there being less interest in producing these substances in Great Britain, France, Spain and Italy. The writer draws attention to the fact that the OSTWALD process for the transformation of ammoniacal nitrogen into nitric acid does away with a great deal of the importance of the distinction between the market for nitric nitrogen on the one hand and that for ammoniacal nitrogen and cyanamide on the other. He concludes, eventually, that one must take into consideration on the one hand the continued efforts made in order to reduce the price of the unit of nitrogen, and on the other, the geographical and economical factors which favour the concentration of the nitrate of soda industry in Chili.

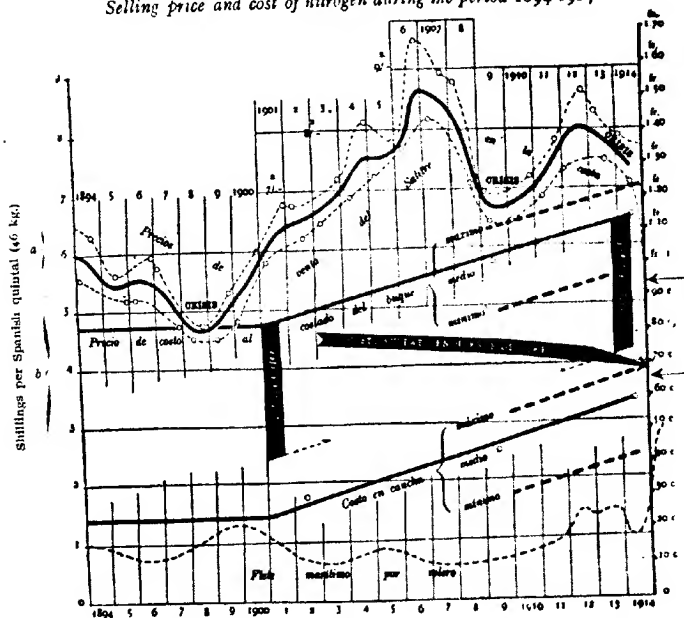
The article concludes with a series of 33 supplementary notes (explanatory, statistical etc.) and 3 appendices dealing with: the terminology of nitrogenous materials — organic nitrogenous fertiliser — encouraging the production of nitrogenous substances — the nitrogen monopoly projected in Germany.

Progress in the production of various nitrogenous materials,
calculated in English tons of nitrogen.



a = production of nitrogen from nitrate of soda and sulphate of ammonia in 1894; b = the same in 1904; c = production of nitrogen from: nitrate of soda, sulphate of ammonia by distillation and by synthetic nitric acid and calcium cyanamide in 1913-14; d = the same in 1916-17.

Selling price and cost of nitrogen during the period 1894-1914.



a = --- selling price of nitrate of soda at Chilean coast; — average price *id. id.*
b = — average annual cost of nitrate of soda at quay-side; --- maximum and minimum; *darcho* =
export dues.
c = — average annual cost of nitrate of soda at the factory; --- maximum and minimum; ---
freight Europe, sailing ship.
d = cost of Norwegian nitrate (of lime); e = cost of sulphate of ammonia from coke furnaces; f = cost
of synthetic ammonia and of calcium cyanamide.

II. — The 2nd. article describes by means of graphs, which we reproduce herewith, the economic history of nitrate of soda and other nitrogenous substances during the last 20 years.

The graph portrays the following facts :

- 1) The increase from year to year of the world's production of combined nitrogen.
- 2) The proportional increase of sulphate of ammonia in relation to the total production of combined nitrogen.
- 3) The important place which, according to likely data, will be taken by synthetic nitrogenous substances in the production of combined nitrogen, at the end of the present war.

III. — In a 3rd. article on the condition of future markets, the writer gives data confirming his earlier forecast of the principal competitors in the nitrate of soda industry and makes special reference to the Report presented to the German Reichstag by the Commission on the nitrogen monopoly.

IV. — The 4th. paper gives fresh forecasts on the economic conditions of the production of nitrate of soda and of other nitrogenous substances in Chili. The following facts are brought out :

- 1) The recovery of nitrogen from coal (for which possible increase in output, and reserves constitute a margin of production 25 times as great as the maximum available in the nitrate of soda deposits) is progressing in a manner relatively superior to that of nitrogen in the form of nitrate of soda.
- 2) The first synthetic nitrogenous products (nitrolim and calcium cyanamide) up till 1912, only made slow progress, whilst the production of synthetic ammonia (HABER process) suddenly became of commercial importance in 1913, by giving financial results which up till May 1914 were regarded as safe in competent circles.
- 3) The war has obliged Germany (and this state of affairs will continue) to nationalize the production of nitrogen in order to render herself independent of outside sources in all circumstances whatever, and the prolongation of the war will strengthen this important industry more and more every day.
- 4) The present war, without rendering the production of nitrogenous substances obligatory in other countries, who are or will be big consumers, has shown the advantage which a country has in producing these substances itself.

An appendix gives tables constructed with the coefficients of the International Institute of Agriculture, which allows of the conversion to unity of the prices of nitrate of soda and of sulphate of ammonia.

V. — The writer discusses the data relative to the extension, wealth, and probable life of the Chilian nitrate of soda deposits, concluding that there exist in the country, at the present moment, 200 million tons of utilisable nitrate of soda, i. e. capable of being extracted at an average price (at the deposit) of 3.75 fr. per Spanish quintal (46.02 kg.), equivalent to a minimum content in the mineral treated of 10 % of nitrate of soda ; but this estimate does not include unexplored deposits.

VI. — Finally, in the text of the discussion cited at the close, the writer explains that the kilo of nitrate of soda delivered in Europe is calculated as follows :

Price at deposits, labour, fuel and depreciation . . .	0.48 fr.
Carriage to Chillan coast, commission	0.11 "
Export dues	0.41 "
Freight, insurance and commission	0.30 "
	<hr/> 1.30 fr.

If the cost of production were reduced by means of installations on a large scale, the amount of commission paid diminished by 2 % by centralising the sale, and freight and insurance lowered by 3 % by means of direct consignments, it should be possible to produce a kilo of nitrate of soda at a French port at the following price.

Cost of production	0.39 fr.
Carriage to coast	0.09 "
Freight, etc	0.27 "
	<hr/> 0.75 fr.

The price of the metric ton of nitrate of soda at 95 % i. e. containing 155 kg. of nitrogen, would thus be less than 120 fr. at a French port.

The quantity of nitrate of soda utilisable in Chili being 200 million metric tons, this country would be able to put on the world market 3 million tons of nitrate every year for 70 years. Allowing, however, an annual increase in production of 55 000 tons (this figure being based upon past years) the end would be reached in 1966. In these calculations no account has been taken of unexplored deposits, the capacity of which is estimated by competent persons as being certainly 4 to 5 times that of the deposits already in working or explored.

625 - **The Effect of Weeds upon Cereal Crops.** — BRECHLEY, WINIFRED E. (Rothamsted Experimental Station) in *The New Phytologist*, Vol. XVI, Nos. 3 and 4, pp. 54-76. London March and April 1917.

The practical results of the competition of weeds and crops are well known, but the exact cause of this competition is less obvious. It is common knowledge that the weeds utilise food and water from the soil and, above ground, tend to rob the crop of much of the sunlight essential to full development. Apart from this, however, it has often been questioned whether the weeds may not excrete from their roots some poisonous substance which actually inhibits the growth of the crops, but the whole matter is very undecided.

The present paper gives the results of pot and water-culture experiments carried out at Rothamsted over a period of 4 years with crops and weeds grown in association. The following combinations were tested, the conditions being varied as far as possible to imitate natural conditions except that the pots were protected from birds.

The pots with wheat or weed alone received twice as much seed as was sown in the mixed pots; i. e. two parts of wheat or weed when alone and one part wheat + one part weed when mixed.

I. — POT EXPERIMENTS *Papaver Rhoeas* + *Papaver Rhoeas*, *Flapaver Rhoeas* + Wheat, Wheat + Wheat, Wheat + *Alopecurus agrestis*, *Alopecurus agrestis* + *Alopecurus agrestis*, *Brassica alba* + *Brassica alba*, *Brassica alba* + Wheat, Wheat + *Spergula arvensis*, *Spergula arvensis* + *Spergula arvensis*.

II. — WATER-CULTURE EXPERIMENTS. Wheat + *Spergula arvensis*, Wheat + *Alopecurus agrestis*.

The conditions and results of the various experiments are set out in detail, the total dry weights of the resulting crops of cereal and weed being given in each case. The conclusions are as follows:

There is no evidence, and indeed no indication, that any direct toxic action comes into play.

It is evident that the mere competition of plant with plant, irrespective of species, has much to do with development and that the time and duration of competitive check are the chief factors involved. Purely vegetative competition is more potent than is generally realised. In the experiment all the crop plants were at least 4 or 5 inches apart, and the effects of overcrowding were most obvious. In a field where weeds are at all prevalent, the plants are still more closely placed, and the struggle must be still keener. Even when the weeds are suppressed by cultivating and hoeing, the roots remain in the soil to a large extent, and those of the perennials at least continue functioning in a normal way, though to a less degree; nevertheless, such suppression of weeds is all to the advantage of the crop, owing to the removal of the aerial competition.

The vital factor in competition is the mere presence of other plants, be they what they may, and, up to a certain limit, two plants cannot make such good individual growth in a given restricted area as can one plant.

In those cases where the same soil was allowed to serve for experiments in successive years a comparison of the dry weights, pot for pot, did not show any evidence that the crop obtained from any individual pot in the first year in any way affected that obtained in the year following. This is a further proof of the absence of toxic effects from the roots. If toxins had been present a pot which carried a relatively small crop in 1915 might have been expected to carry a relatively large one in 1916 and vice-versa, as the large crop would have left a larger supply of toxin in the soil. As no such correlation was proved it seems evident that no toxin capable of remaining unchanged from one season to the other was present in the soils.

626 — **Assimilation of Iron by Rice from Certain Nutrient Solutions.** — GNE, P. L. and CARRERO, J. O. (Porto Rico Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. VII No. 12, pp. 503-528. Washington, D. C., 1916.

It has long been recognized that on calcareous soils certain plants do not make a normal growth and are often affected by chlorosis. This has been variously ascribed to the physical condition of the soil; an increasing assimilation of lime by the plant; a diminished assimilation of all mineral nutrients due to the neutralization of acid root excretions. Previous

work at the Porto Rico Agricultural Experiment Station with pineapples and upland rice indicated an insufficient assimilation of iron as the principal cause. As calcareous soils have a slightly alkaline reaction, and as it is important to know whether plants intolerant of calcareous soils are sensitive to an acid or alkaline reaction *per se*, and whether the reaction of the soil has any effect on the assimilation of iron, further experiments with upland rice (*Oryza sativa*) in nutrient solutions and soil cultures have been conducted.

The experiments with nutrient solutions reported show the effect of the quantity and form of iron and reaction of the nutrient medium on the assimilation of iron by rice. In nearly all cases growth was much better in the nutrient solutions employed with 0.008 gr. of iron per litre than with 0.002 gr. When judged by the growth of plants, ferrous sulphate, ferric citrate, and ferric tartrate afforded sufficient iron when used in proper quantities in the acid and neutral solutions. Ferric chloride was an inferior source of iron, and dialyzed iron utterly inadequate. Only ferric tartrate furnished sufficient iron in the alkaline solution. Plants grown in the acid solutions contained the highest percentages of iron. Plants grown in the neutral solutions contained higher percentages of iron than those grown in the alkaline solutions when some forms of iron were used, but equal percentages when other forms of iron were used. The percentages of nitrogen, phosphoric acid, lime, magnesia, and carbon-free ash in plants grown in six different solutions did not vary appreciably when compared with the iron content. It was evident that rice was not particularly sensitive to the reaction of the solution, except as the reaction influenced the availability of the iron. This substantiates previous work in showing that lime-induced chlorosis is caused by a lack of iron and indicates strongly that the only action of carbonate of lime in inducing chlorosis lies in diminishing the availability of the iron. The amount of available iron in the different solutions could not be determined analytically, because of the impossibility of distinguishing between colloidal and soluble iron. Calculations showed, however, that the concentration of available iron in many cases must have been less than one part in 10 000 000 of solution.

Reference is made to the bearing of these results on the proper composition of plant nutrient solutions.

A bibliography of 15 works is appended.

- 627 - Pollination and Cross-Fertilization in the Juar Plant (*Andropogon Sorghum*, Brot.). — DOUGLAS, GRAHAM, R. J., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VIII, No. 4, pp. 201-216, XII figs. + 2 plates. Calcutta, December, 1916.

In successive generations of hybrids of "juar" (*Andropogon Sorghum*, Brot.), certain characteristics, such as the colour of the grains and the shape of the glumes, divide and re-combine according to Mendelian laws, in the most simple manner.

1) COLOUR OF THE GRAINS. — The crossing of a red plant (RR) with a white one (rr) gives, in the 1st. generation (F₁) a red hybrid without interme-

diate colour which produces 4 kinds of gametes: — RR (red) — Rr (red) — rR (red) — rr (white). In the 2nd. generation (F_2), $\frac{3}{4}$ of the plants should be red, and $\frac{1}{4}$ white, according to the ratio 3:1. The actual ratios obtained were 3:1 and 2.2:1, which correspond exactly with the theoretical calculation.

The cross between *red* \times *yellow* gives similar results, with dominance of the red to the yellow. Of 126 plants of F_2 , 94 were red and 32 white, according to the ratio 2.9:1, which is very near to the theoretical ratio 3:1.

The results obtained in the series *yellow* \times *white* were much the same as those for *red* \times *white* and *red* \times *yellow*, with dominance of the yellow over the white. Thus, of 16 plants of F_2 , 12 had yellow grains and 4 white grains, in exact accordance with the ratio 3:1. In some cases, however, individuals appear in F_1 whose progeny in F_2 is a mixture of white, red and yellow grained individuals. In such cases it seems clear that the white contains a determinant of the red, which, however, exists in the latent state and is only capable of developing in the presence of the yellow. The hybrid of F_1 with formula $Rr Yy$, heterozygous to 2 characteristics, produces 4 kinds of gametes: — RY — Ry — rY — ry , capable of giving, in F_2 , 16 different combinations, of which 9 should be red, 3 yellow and 4 white, as shown in the table below:

Constitution of the hybrids of F_2 .

		Male gametes of F_1			
Female gametes of F_1	σ	RY	Ry	rY	ry
	♀				
	RY	$RRYY$	$RRYy$	$RrYY$	$RrYy$
	Ry	$RRYy$	$RRyy$	$RrYy$	$Rryy$
	rY	$RrYY$	$RrYy$	$rrYY$	$rrYy$
	ry	$RrYy$	$Rryy$	$rrYy$	$rryy$
Constitution of the hybrids of F_2					

The experimental values found are in accordance with the theoretical ratio 9:3:4 between red grained, yellow grained and white grained hybrids.

2) LENGTH OF THE GLUMES. — The "long glume" and "short glume" characters act as a pair of allelomorphs with dominance of the "short glume" character. Of 80 plants of F_2 resulting from a cross between these two characters, 60 had short glumes and 20 long glumes, that is to say, they followed exactly the theoretical ratio 3:1.

As the specific behaviour of each of these factors (red, yellow or white colour of the grains; long or short glumes) is known, it is easy in each case, by applying the laws of the division and re-combination of the characters, to foresee the composition of the progeny of any hybrid of *Andropogon Sorghum* Brot, so far as the characters studied in this paper are concerned.

628 - Potato Selection Experiments in Germany. — WACKER, H., in *Zeitschrift für Pflanzenzüchtung*, Vol. IV, Part 3, pp. 267-302, Berlin, 1916.

Since 1908, the writer has carried out a series of potato selection experiments at the seed selection Institute of the Higher School of agriculture at Hohenheim (Württemberg). The object was to form new kinds of potatoes for Southern Germany so as to replace those cultivated so long in the country but now degenerate. The method was to be by sexual reproduction with or without hybridisation. The first was carried out by crossing two varieties and sowing the hybrid seeds thus obtained, the result being new potato plants. The sexual reproduction without crossing was carried out by choosing well developed berries of pure varieties and then continuing to select the plants from the seed obtained thus (1).

The culture of the progeny of the seedlings was always carried out by the method of individual selection in the 2nd. and 3rd. generation, so that the corresponding hereditary characters could also be studied. Less importance was attached to this method during the following generations, when the identity of the descendants of a family could be determined with precision. After the second generation the potatoes were grown with the ordinary spacing of 20 × 24 inches.

SELECTION OF POTATOES OBTAINED FROM THE SEED OF VARIETIES NOT ARTIFICIALLY FERTILISED.

In the first experiment made from 1907-1912 with the varieties: Nols-Sämling, Münchinger, Alma, Rekord, Modell, Bohun, Fürstenkrone, De Wet, Bojar, Eva, Switez, Diana, the berries were gathered in the autumn of 1907 and sown on March 27, 1908; lifting was carried out 17 to 19 days later. The plants continued to grow normally. Transplanting was finished by the middle of May, and by the 30th. of the same month, all the seedlings were planted out in the open field. The tubers obtained showed fairly large variations as regards shape, size, colour, arrangement of the eyes, etc.

However, to continue the selection in the following years, only tubers of the varieties Münchinger, Nols Sämling, Bohun were chosen, and were selected till 1912. In that year an experiment was made to determine the comparative value of the 3 varieties.

This experiment showed that, for the Münchinger variety all the selections of the parent form had given negative results, and they were therefore abandoned.

(1) These operations, as well as the cultivation of the seed plants were usually carried out according to the way described by FRIEDRICH in his work: *Züchtung der landwirtschaftlichen Kulturpflanzen*, Vol III, pp. 32 and onwards, Berlin, 1910. Parey.

The Bohun variety did not give satisfactory results, the parent form having given bigger yields in tubers than the forms grown from the seed. Selection of this variety was discontinued, as was later done with the Noces Sämling variety.

In a second experiment (1909-1912), the varieties Agraria, Alma, Münchinger and Switez were selected. The seeds were gathered in the autumn of 1908 and sown on March 23, 1909. The plants grew normally, and were replanted on April 28 and 29, being planted in the open field on May 26. With the exception of plants grown from seed of the Agraria variety, which were weakly, all the plants developed normally during the summer. The former were abandoned the first year, while the latter were grown during successive years, during which they were subjected to individual selection. There was usually an appearance of uniformity among the plants of the same selection, but there were also considerable differences. The Alma variety was eliminated in the second generation, as was the Switez variety in the third, only the Münchinger variety being left. The plants of the latter variety gave, in the fourth generation, a much higher yield than the parent forms. Nevertheless, the yields were found to be too low, so the selection of this variety was also abandoned.

In a third trial, the writer used "Unterländer Wurstkartoffel", a variety chiefly grown between Stuttgart and Heilbronn, and considered very good. The berries were collected in the autumn of 1910 and sown in the following spring. The growth of the first generation plants, in 1911, did very well; plenty of well developed tubers of a yellow or red colour were obtained. For the selection of the second generation, 71 plants with red tubers and 36 with yellow tubers were chosen. However, the results were not satisfactory, and it was possible to continue the selection of a few strains only. The third generation gave very bad results. For this variety as well as the preceding ones, the method of sexual reproduction without crossing has not proved of value.

ARTIFICIAL CROSSING OF SEVERAL VARIETIES AND SUBSEQUENT SELECTION OF THE DESCENDANTS.

The following crosses were made:

- 1) Switez ♀ × Münchinger Original ♂
- 2) Switez ♀ × 2nd. generation Münchinger plant
- 3) 2nd. generation Münchinger ♀ plant × 2nd. generation Noces Sämling ♂ plant.
- 4) 2nd. generation Münchinger ♀ plant × Münchinger, Hohenheimer Nachbau ♂.

Artificial pollinisation was easily carried out.

The writer considers the cross between Switez and Münchinger as of the most importance, as is shown by the large number of fertilised plants resulting. This cross tended to rejuvenate the Münchinger variety, the yield of which had considerably diminished.

Crossing was carried out in 1909, the resulting seed being sown in 1910.

The young plants grew normally, but none of the groups obtained were uniform. The colour of the flowers and tubers varied considerably.

For breeding, 67 plants were chosen; a very variegated mixture of tops and tubers were obtained, but they appeared sound and healthy. This chiefly occurs in crosses between the Switez and Münchinger varieties, which have both given, on crossing, better results than their parent forms.

For the continued selection, 14 plants of the Switez-Münchinger cross were chosen, in consideration of their characters for regularity of development, high yielding capacity, well shaped tubers with yellow flesh.

In the 3rd. generation unequal growth and development was noticed. A few specimens were attacked with leaf curl, and *Phytophthora infestans* was only slightly present on the stems. Both starch content and yield in tubers varied greatly. This diversity is all the more surprising since the tubers had been carefully sorted in the 1st. and 2nd. generations. For this reason, all the poorer grades were eliminated and only 9 plants were used to continue the selection.

The 4th. generation (obtained from the 9 plants) were grown separately according to the family and in parallel with one of the maternal parents, the Switez variety. During this operation, 2 lines (22-6 and 22-7) showed themselves to be undoubtedly the best and most uniform, fulfilling all the writer's requirements. Their yield in tubers is much higher than that of the parent form Switez.

The 5th. generation was quite satisfactory, the yields being 203.1 and 215.3 cwt. respectively per acre. The proportion of small potatoes was 2 per cent.

In the 6th. generation, the lines 22-6 and 22-7 yielded respectively 243.7 and 191.2 cwt. per acre. This difference was solely due to differences in manuring. In addition the lines 22-6 and 22-7 showed very good disease-resisting qualities.

On account of these good results the writer made further crosses, in 1913, the varieties used being most carefully chosen.

The crosses were:

Switez ♀ × Industrie ♂	Switez ♀ × Blochinger ♂
Industrie ♀ × Switez ♂	Wurstkartoffel ♀ × Switez ♂
Industrie ♀ × Wurstkartoffel ♂	Switez ♀ × Wurstkartoffel ♂

The crosses were all successful, as was the cultivation of the plants obtained from the hybrid berries. The plants of the first generation differed much from one another. The 2nd. generation from the crosses made in 1913 gave very satisfactory results. The yield in tubers was higher than the former one. The selection of the 2nd. generation was, therefore, continued. It is probable that the crosses Switez ♀ × Wurstkartoffel ♂ and Industrie ♀ × Wurstkartoffel ♂ will yield varieties that will fully meet with the approval of the agriculturists of Southern Germany.

CONCLUSIONS.

1) The frequent observation that the growth of plants obtained from non-hybridised potato berries results in no improvement of the variety is fully confirmed by these experiments. The first generations obtained in such a way show abundant growth and give rise to the idea that sexual reproduction has improved the variety, but, even after the 3rd. and 4th. years of cultivation, the plants decline and finally give a much inferior yield to that of the parent forms. This decline of the progeny during the course of other generations has been observed by the author not only in the old varieties of the country, such as Münchinger and Unterländer Wurstkartoffel, but also in the new and very vigorous varieties, such as Switez, Bohun, Alma, etc.

2) On the other hand, selection by crossing gives a better result, especially when the subjects crossed are of healthy, new and vigorously-growing varieties. Certain characters feebly present in the one variety, should be strongly present in the other.

3) As the potato plant seems, in the great majority of cases, to be a heterozygous plant, no uniformity can be seen in the first generation, either in plants obtained by artificial hybridisation or in plants obtained by hybridisation in other ways. There is nearly always a certain concordance of characters among the plants of some determined variety or cross, but there always appear variations, more or less strong according to the type of the variety.

4) In the descendants of seedling plants which should be considered as lines of vegetative reproduction, there occur not only the usual little regular variations, but sometimes large individual variations that are entirely hereditary. Thus, also with potatoes, it is possible to indicate fairly accurately the possibility of a selection based on vegetative reproduction.

629 - Studies on the Hybrids of *Capsicum annuum*: Part II. On some Variegated Races. — Ikeno, S., in the *Journal of Genetics*, Vol. 6, No. 3, pp. 210-220, 2 figs., VIII plates, Cambridge, April 1917.

In the botanical garden of Komaba, near Tokyo, in 1913, many individuals of *Capsicum annuum* were noticed which were remarkable for a yellow variegation, not only of the leaves, but also of the branches, various parts of the flower and the fruit. This characteristic, due to the formation of patches lacking in chlorophyll, develops in different degrees of intensity in different individuals, and, in some cases, consists of a few small yellow spots scattered over the leaves. When, on the other hand, the yellow surface is greatly developed, the plant presents a distinctly pathological appearance and grows slowly and with difficulty. The results are given of a study on the progeny of these variegated specimens, obtained both by self-fertilisation and by hybridisation with a normal green plant.

The intensity of the variegation is in direct proportion to that of the parents. If the progeny are divided into intensely variegated plants (*i. var.*) and slightly variegated plants (*s. var.*), it can easily be seen that the

percentage of the second type decreases as the proportion of the variegation of the parent plant increases, and vice versa.

1913	1914	1915	1916
	s. var. 84 (= 25 %)	s. var. 294 (= 92 %)	
		i. var. 25 (= 8 %)	
f. var.	i. var. 254 (= 75 %)	s. var. 95 (= 66 %)	
	green branches	i. var. 49 (= 34 %)	
	variegated branches	s. var. 80 (= 34 %)	s. var. 14 (= 17 %)
		i. var. 152 (= 66 %)	i. var. 68 (= 93 %)

It is interesting to note the specific manner in which the various parts of the plants tend to transmit their characteristics integrally; thus, fruit produced on the green branches of intensely variegated plants give a percentage of intensely variegated plants much inferior (34 %) to that borne by variegated branches of the same plant (65.5 %).

In no case were completely green plants obtained. By crossing with normal green plants, variegated individuals were obtained in the 1st. generation whose descendants in the 2nd. generation, whether obtained by self-fertilisation or by crossing with green specimens, were variegated. This second generation showed no scission between the green and variegated characteristics in the Mendelian sense of the word; the only deviations noticed were in the variegation, never in the self-coloured green. The characteristics under consideration were, therefore, not Mendelian. If successive generations are constantly crossed with the normal green type the variegation shows a tendency to decrease, but never disappears altogether.

Partial chlorosis in the leaves, branches and fruit of *Capsicum annuum* is not transmitted by the cellular nucleus of the egg, but by the cytoplasm, or more correctly speaking, by the plastids (leucites) which it contains, plastids which, unlike the chloroplasts, do not possess the faculty of producing the chlorophyll-pigment. In the variegated specimens, the egg-cells contain a certain number of plastids of both kinds, that is to say normal and diseased. During the segmentation of the fertilised egg, the plastids also multiply rapidly by fission and enter the cells in varying quantities and proportions, so that, in an adult plant, the distribution of abnormal plastids is far from being uniform, but varies very greatly in the different organs.

This hypothesis explains: 1) the absence of Mendelian phenomena; 2) the behaviour of progeny whose intensity of variegation is proportionate to that of the parents; 3) the attenuation of the variegation as a result of repeated crossing with normal green individuals.

Similar facts have been described for *Mirabilis albomaculata* (CORRENS), *Antirrhinum majus albomaculatum* (BAUR), *Melandrium (Lychnis dioica) chlorinomaculatum* (SHULL) and *Primula sinensis* (GREGORY). These observations are the first to be published for *Capsicum*, and are interesting in connection with constitutional chlorosis in plants and its inheritance.

630 - **Reduplication Series in Sweet Peas.** — Punnett, R. C., in the *Journal of Genetics*, Vol. VI, No. 3, pp. 185-193, III tables, Cambridge, April, 1917.

This paper is a continuation of previous work (1) on the degree of affinity between the various characters in the formation of sexual cells or gametes ("coupling", "Faktorenkuppelung"). The results of experiments carried out in 1914-1915 with *Lathyrus odoratus* (Sweet Pea) are given. The data deal only with the BEL series, where B = the blue colour of the flower as opposed to the red, b; E = an erect standard as opposed to a hooded standard e; L = long pollen as opposed to round pollen l.

1) *The relation between E and L in homozygous plants with reference to the colour (BB or bb).* The mating EL × el, which does not, of course, change the colour, gives, in the 1st. generation, individuals with the formula Ee Ll, capable of producing 4 kinds of gametes: EL — El — eL — el. In the F₂, 1118 plants were obtained and examined. They were divided up as follows:

	EL Erect standard Long pollen	E Erect standard Round pollen	eL Hooded standard Long pollen	el Hooded standard Round pollen
Number of plants found.	765	62	71	220
Expectation on 7:1:1:7 basis. . .	773	65.5	62.5	214

If, as is usual, 4 sorts of gametes are formed in equal proportions: EL: 1 El: 1 eL: 1 el), and if they have equal opportunities of recombining, F₂ should give very different values from those actually obtained:

EL (630 (9/16))	E (280 (3/16))	eL (280 (3/16))	el (70 (1/16))
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This fact is explained as follows: — E and L on one hand, and e and l, on the other, have a greater coupling intensity than that which exists between e and L on the one hand, and l and E on the other, the ratio being EL: 1 El: 1 eL: 7 el. In the division of the 1118 plants of F₂ this ratio would give figures very near to those actually obtained. The actual figures are given in brackets: 773 (765) — 65.5 (62) — 65.5 (71) — 214 (220).

2) *Relation between the colour of the flower and the shape of the pollen.* — In 1912 a red hooded plant with round pollen was crossed with a Lord Nelson, a full blue with long pollen and hooded standard. F₂ was composed of purple hooded plants with long pollen. The 632 plants of F₂ were divided up as follows:

EL 419	E 29	eL 57	el 127
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(1) Cf. *Journal of Genetics*, Vol. III, 1913, p. 77.

As in the preceding case, these proportions may be explained by assuming the number of gametes BL and bl to be 7 times as large as that of Bl and bL, so as to give the ratio 7:1:1:7. Values closely related to the ones obtained could then be calculated: — 437 (419) — 37 (29) — 37 (57) — 121 (127).

3) Relation between the colour of the corolla and the shape of the standard.
— The mating BEL × bel gave, in F₂, 1 803 plants divided as follows:

BE	Be	bE	be
1296	12	10	48*

This case, therefore, differs from the preceding ones; instead of the ratio 7:1:1:7, we have the ratio 63:1:1:63. Values approaching the actual ones may thus be obtained: — 1 337 (1296) — 14 (12) — 14 (10) — 438 (485).

These investigations are interesting and important not only for biological science, but also for its practical application. The results given above for the 2nd. generation of hybrids may help the breeder to greater accuracy in the combination and re-combination of the most valuable characters in the different varieties cultivated.

631 — Studies in the Inheritance of Doubleness in Flowers, II. *Meconopsis*, *Althaea* and *Dianthus*. — SAUNDERS, EDITH R., in the *Journal of Genetics*, Vol. VI, No. 3, pp. 165-181, Cambridge, April, 1917.

As a continuation of her work on the genus *Petunia* (1) begun in 1911, the author has made a careful experimental study of the nature and capacity of transmission of the double character in the genera *Meconopsis*, *Althaea* and *Dianthus*. Results were obtained which are of interest not only for science, but also for practical selection in horticulture.

Meconopsis cambrica (Welsh Poppy). — In the double flowered type this characteristic, even in one and the same individual, shows infinite gradations, from the almost normal type to sterile flowers where all, or nearly all, of the stamens are present in the form of petals. The cross between single-flowered and double-flowered types gives in the F₁ (1st. hybrid generation) individuals with double flowers, and in the F₂ (2nd. hybrid generation) a ratio of 3 doubles to 1 single; the double character is, therefore, dominant.

Althaea rosea (Hollyhock) and *A. ficifolia* (Antwerp Hollyhock). In the F₁ generation the individuals showed intermediate characteristic. In the F₂ generation, however, the ratio was 1 single; 2 crossbreds: double; there is, therefore, no specific dominance of either characteristic. The hybrids in F₁ with the formula D S (D = double; S = single), may give, in F₂, 4 different groupings: DD — DS — S D — S S. If all these groups have equal chances of developing, the progeny produce will be in the following ratio: — 1 double: 2 crossbreds: 1 single

(1) Cf. SAUNDERS, E. R., Studies in the Inheritance of Doubleness in Flowers, I. *Petunia* in the *Journal of Genetics*, Vol. I, p. 57, Cambridge, 1910.

Dianthus Caryophyllus (Carnation): — Behaviour similar to that of *Meconopsis*.

Dianthus barbatus (Sweet William). — In the double variety, the stamens take the form of petals. If a single is crossed with a double, the individuals of F_1 will be singles, and the F_2 generation will include 3 singles to 1 double. Unlike *Meconopsis cambrica* and *Dianthus Caryophyllus*, the single character is in this case dominant to the double.

632 — **Dry Farmed and Irrigated Wheat.** — JONES, J. S. and COLVER, C. W., in *University of Idaho Agricultural Experiment Station* (Departments of Chemistry and Home Economics), Bulletin No. 88. 20 pp., 3 tables. Moscow (Idaho), 1916.

This report on dry-farmed and irrigated wheat covers the completed portion of a general investigation which was commenced in 1907 and which has for its ultimate object the study of the factors which determine the protein content of normally matured wheat.

Gluten is the most important constituent of wheat flour because it makes possible the baking of light bread. The gluten content of flour depends upon the protein content of the wheat from which it was ground and, although flours may vary rather widely in the percentage content of gluten without varying to the same extent in baking value, a reasonable percentage of gluten is absolutely necessary to insure satisfactory results under normal conditions of baking.

There is a widespread feeling among investigators, grain buyers and millers, that the maintenance of quality in wheat depends primarily upon the maintenance of a high protein content and that the improvement of northwestern grown wheat is intimately connected in some way with a substantial increase of that constituent in the commonly grown varieties. At any rate, those wheats which establish the standards of excellence in milling centres are relatively high in protein and produce flours of relatively high gluten content. Finally, experience teaches that no matter what other objects the wheat breeder may attain, they are for practical purposes almost valueless if, in their attainment, protein content is materially sacrificed.

In the Pacific North West, wheat is cultivated under very variable conditions. Whether or not quality could be correlated in any marked degree with such differences appears to be ascertainable only by the systematic collection of samples through a term of years, and the performance of the necessary analytical work and baking tests. The first report was made in 1911. This one is supplementary to a certain extent, but deals specifically with wheat grown in south Idaho under two radically different systems of farming — dry-farming and irrigation. The samples reported upon were grown and secured for analytical, milling and baking tests in 1912, 1913 and 1914.

Examination of the data secured suggests that possibly some varieties of wheat respond more quickly to changes of environment than do others. This seems to be particularly true of Turkey Red and Marquis. Nevertheless, the protein of the average dry-farmed sample was only one per cent.

TABLE I. — *Mill Products.*

Variety and how grown		Bras	Shorts	Flour	Gain (+) or loss (—) in milling percent.
Bluestem	dry-farming	12.87	18.45	67.99	— 0.69
Bluestem	irrigated	12.45	18.51	68.26	— 0.78
Bluestem (Haynes)	irrigated	10.42	17.80	75.17	+ 3.39
California Club	irrigated	24.52	11.30	62.50	+ 1.68
Canadian Hybrid	dry-farming	10.67	17.00	74.15	+ 1.82
College Hybrid	irrigated	15.87	17.46	61.90	— 4.77
Colorado No 50	dry-farming	14.62	17.58	70.98	+ 3.18
Dago	irrigated	10.64	16.60	75.74	+ 2.98
Defiance	irrigated	12.75	16.88	71.81	+ 1.44
Dicklow	irrigated	14.23	16.19	69.62	+ 0.04
Fife	dry-farming	14.72	15.35	70.98	+ 1.05
Forty Fold	dry-farming	12.77	19.67	68.60	+ 1.08
Fultz	dry-farming	16.67	15.00	66.67	— 1.66
Gold Coin	dry-farming	13.54	17.15	70.83	+ 1.52
Galgals	irrigated	14.41	14.40	71.19	—
Indian	irrigated	20.25	15.19	64.13	— 0.43
Jim Holley	irrigated	15.12	16.20	70.18	— 1.50
Koefert	dry-farming	15.38	13.68	70.94	—
Little Club	dry-farming	10.00	16.00	72.00	— 2.00
Little Club	irrigated	12.70	12.43	74.10	— 0.77
Loft House	dry-farming	8.03	22.63	64.60	— 4.74
Mackay	dry-farming	9.23	19.23	70.00	— 1.54
Mackay	irrigated	11.94	19.42	68.64	—
Marquis	dry-farming	13.34	20.00	68.32	+ 1.66
Marquis	irrigated	11.65	15.64	77.15	+ 4.44
Minnesota No 163	irrigated	16.53	10.59	74.16	+ 1.28
Odessa	dry-farming	14.17	17.50	68.33	—
Red Chaff	dry-farming	15.56	14.82	64.44	— 5.18
Sonora	dry-farming	14.68	20.67	63.26	— 1.39
Sonora	irrigated	14.17	19.17	65.00	— 1.66
Tause	dry-farming	14.53	15.38	65.39	— 4.70
Three I.	dry-farming	11.53	17.79	72.32	+ 1.64
Turkey Red	dry-farming	11.78	18.06	73.33	+ 3.17
Turkey Red	irrigated	10.26	19.58	74.06	+ 3.90
Winter Fife	dry-farming	9.53	17.13	43.71	+ 0.37
Averages of irrigated varieties*		12.62	17.93	70.62	+ 1.17
Average of dry-farmed varieties**		12.64	17.04	71.24	+ 1.12

* Total number of samples analysed: 79.

** Total number of samples analysed: 60.

greater and the protein of its flour only seven-tenths per cent. greater than that of the average irrigated sample — differences too small to be strongly reflected in the gluten percentage either wet or dry. There were no significant differences between the average dry-farmed and irrigated sample in weight per bushel, in weight per 1000 grains, or in percentage of moisture, ash and fatty matter.

• Results of baking tests in many ways do not support the commonly

TABLE II. — Composition of the wheat and flour.

[illegible]

held views regarding the relative values for bread making purposes of dry farmed and irrigated wheat. They suggest the possibility of making greater progress toward the raising of flour standards in this state by a systematic insistence on the part of housewives for brands of flour that have been ground from the better varieties of wheat rather than by discrimination in favour of either the dry-farmed or the irrigated product.

633 - Study on the Digestibility of the Grain Sorghums. — LANGWORTHY, C. F. and HOLMES, A. D. in *United States Department of Agriculture Bulletin No. 470*, pp. 31 Washington December 22, 1916.

As a result of research into the crops best suited to the semi-arid regions of the Western United States, non-saccharine grain sorghums have been successfully introduced from South Africa. The best known varieties of this cereal are feterita, kafir, dwarf milo and kaoliang.

Experiments are now being made on the best method of utilising these grains. Much has already been published on their use as a feeding-stuff for cattle, but little work has been done on their value as food for human consumption (on this subject see: *U. S. Department of Agriculture, Farmers' Bulletin 559* (1913), pp. 6-7; *Northwestern Miller*, 1912, No. 2, pp. 79-80; *Oklahoma State Circular 27*, (1914), 8 pp.; *Texas Department of Agriculture Bulletin 41* (1915), p. 18; *Operating Miller 20*, 1915 No. 1, pp. 42-44; *South Dakota Agricultural Experiment Station Bulletin 158* (1915) pp. 170-174). The results of these experiments on the milling of these cereals and their value in human nutrition may be summarised as follows:

In the first set of experiments the rations included milk, sugar, fruit (oranges) and "hard" sorghum bread. This bread was prepared by mixing meal and water (in equal volumes), salt and lard boiled for half an hour; baking powder was then added and the bread baked in a very thin layer. The bread thus obtained was very dry, hard with a thick crust and practically no crumb, and was rather insipid. It was found that 58 % of the protein of the cereal had been digested. It is possible that owing to the high proportion of milk protein in the ration, the figure given for the cereal protein alone may exceed its actual value.

In the later, more numerous experiments the grain was eaten in the form of a softer bread or of mushes. This "soft" bread was made as follows: 15 cups of meal, 3 $\frac{3}{4}$ teaspoons of soda, 1 $\frac{1}{4}$ cups of molasses, 3 $\frac{3}{4}$ teaspoons of salt, 5 teaspoons of ginger, 1 small cup of lard (melted), 1 $\frac{7}{8}$ quarts of hot water. The mixture was kneaded and baked for about 1 $\frac{1}{2}$ hours.

The mush was prepared by adding to the meal the requisite amount of salt and a little more boiling water than could be absorbed. The whole was then boiled for 3 to 4 hours in a double boiler at a temperature just below boiling point. The bread and mush thus prepared were very palatable. The basal ration consisted of apple sauce, potatoes, butter and sugar.

On the average 51 % of the protein of the soft dwarf kafir bread

was digested, and 48 % of the protein of the dwarf kafir mush. The feterita varieties gave the same percentages. The proportions for the dwarf milo variety were 40 % and 34 % respectively ; and for kaoliang 20 % and 4 %.

Fat was present in these grains in very small and relatively unimportant quantities and, therefore, no attempt was made to estimate its digestibility.

In all cases the *carbohydrates* of the rations and the sorghum were completely utilised. Considering the grain alone, apart from the complete ration, the average amount used was : 98 % for the "hard" dwarf kafir bread, 96 % for the "soft" dwarf kafir bread ; 96 % for the dwarf kafir mush. For feterita the average values were 97 % for the bread and 99 % for the mush ; for dwarf milo, 96 % for the bread and 98 % for the mush ; or kaoliang 96 % for both bread and mush.

For purposes of comparison, digestibility experiments were made with corn and wheat bread prepared by the same method as the "soft" sorghum bread and consumed with the same basal ration. The corn and wheat proteins were found to be digested rather less thoroughly than usual. This is doubtless to be attributed to the excessive simplicity of the ration. The average digestibility of the corn bread protein was 60 % and that of the wheat bread protein 77 % ; that of the carbohydrates was 96 % and 95 % respectively.

The experiments with all the grains were carried out under conditions as nearly uniform as possible so as to obtain directly comparable results. It may be concluded, therefore, that sorghum protein is less digestible than that of corn or wheat.

From the results of these, and other experiments, sorghum may be said to be of real value in human nutrition. At the same time, special methods of cooking are required to make of it a really palatable and nourishing food ; it is of great importance that the meal, whose particles are particularly hard and flinty, should absorb sufficient water to be thoroughly softened.

Sorghum protein is not so completely assimilated as that of wheat or corn, but, with the exception of kaoliang, this grain forms a fairly good source of this nutrient. They also supply a good quantity of carbohydrates in a form which is completely assimilable.

534 - **Researches on the Mechanism of Cleatrisation of Wounds caused by Tapping in Rubber-producing Plants.** — HENRI F., in *Bulletin de l'Office Colonial*, 10th. year. Nos. 110-111, pp. 95-102 + 3 plates. Melun, February-March, 1917.

In practice, preference should be given to the method of tapping which does the least damage to the plants, both as regards length of life and subsequent yield of latex when tapped anew.

The writer gives a detailed summary of two sets of researches conducted in collaboration with M. J. MAHEU, on the microscopic anatomy of the African rubber plants: *Clitandra Arnoldiana* and *Funtumia elastica*. He then concludes as follows : "It is hardly necessary to emphasize the grave drawbacks resulting from incisions which result in large wounds with gaping edges remaining open over long periods."

The processes of regeneration of the lactiferous ducts and the re-establishment of the circulation of the latex demonstrate that, in practice, the best method of tapping is to make use of a number of incisions of small size, thus rendering easier the healing of the lactiferous vessels. Large incisions of circular shape should be abandoned, as they hinder the re-establishment of the circulation of latex by the production of collateral circulatory systems.

635 — Experiments on the Manuring of Cacao in Java, from 1912 to 1914. — PERLE J. R. C. and DE JONG, A. W. K., in *Mededeelingen van het Prostatuut Midden-Java*, No. 24, Batavia, 1917.

In 1911, in the Djati-Roengge plantations, situated in the centre of the island, a set of cacaos was selected for a comparative experiment on the effect of farmyard manure used alone and in conjunction with superphosphate. The trees were treated as usual and the yield noted of dry beans.

The conclusion is that farmyard manure alone only gives a very slight increase, whereas in conjunction with superphosphate the results have been excellent. Compared with the check lots the surplus yield was as follows: 40 % in 1912 — 50 % in 1913 — 63 % in 1914 against 3 to 11 % with farmyard manure alone.

The experiment is to be continued using superphosphate alone.

636 — Cultivation of Beans in Germany: Trials to Determine the Best Number of Plants per Pole. — UNSELT, in *Müller's Deutsche Gärtnerei Zeitung*, Part. 7, pp. 51-52, Erfurt, 1917.

In Germany, the usual number of beans per pole is 5-8, sometimes even 11-13, and many people think that by increasing the number of plants they obtain bigger yields. The writer does not agree with this, as he considers that too many plants give too thick a foliage and many of the leaves live at the expense of others. The consequence is that the yield is reduced and there is a useless waste of seed. The writer himself keeps 3-4 plants per pole and claims to get bigger crops this way than by planting a greater number. In order to prove this he arranged a trial in 1916 using 5 rows of poles, with the following number of seeds to each pole.

1st. row	1 plant per pole
2nd. row	2 plants " "
3rd. row	3 " " "
4th. row	4 " " "
5th. row	5 " " "

The beans (6 pickings) gave the following yields:

	Yield per pole
1st. row	1.066 kg.
2nd. row	2.233
3rd. row	2.233
4th. row	1.333
5th. row	1.266

The poles with 2 and 3 plants gave equal and maximum results. On the other hand, by planting 8-12 seeds per pole the result obtained would, *the very most*, be equal to that of row 5, that is to say the yield would be considerably smaller and the amount of seed used considerably greater.

7 - **Fruit varieties for Maine.** — BROWN, BLISS S., in *University of Maine, Agricultural Extension Service, Extension Bulletin No. 111*, pp. 19. Orono, Maine, January 1917.

Fruit cultivation in Maine covers about 91 000 acres; if the land known as "Blueberry Barrens" (sterile soil covered with a wild growth of *Vaccinium corymbosum*) be added to this, there is a total of 241,000 acres. The value of the fruit industry is about 2 1/2 million dollars per annum. Apples supply 98 % of the fruits and about 90 % of the cash value of all the fruits in the State. The kinds of fruit cultivated are few in number. A list of the most common varieties of each kind and those usually considered the best, is given below (1).

APPLES: — *Spring varieties:* Blue Permain, Northern Spy*, Spitzenburg**, Roxbury Russet, Stark*, Ben Davis**.

Summer varieties: — Red Astrachan**, Yellow Transparent**, Sweet Bough, Chenango (strawberry), Williams.

Autumn varieties: — St. Laurence, Alexander, Wolf River, Duchess (Oldenburg)**, Gravenstein*.

Early Winter Varieties: — Snow (Fameuse)**, Macintosh Red*, Nod Head*, Porter, King*, Wealthy**, Fall Pippin, Rolfe**, Milken**, Grimes Golden, Pound Sweet.

Late Winter Varieties: — Hubbardston, R. I. Greening*, Bellflower**, Rome Beauty**, Delicious*, Winter Banana**, Winter Pippin, Baldwin*, Newtown Pippin, Tolman Sweet**, PEARS: — Bartlett, Sheldon, Seckle, Beurre d'Anjou, Beurre Bosc, Clapp's Favorite, Kieft, Vermont Beauty.

PLUMS: — Abundance, Burbank, Red June, Wickson, Satsuma, Leland, German Prune, Mission, Arctic, Quackenbush.

CHERRIES: — *Sour Varieties:* — Early Richmond, Montmorency, English Morello, May King.

Sweet varieties: — Black Tartarian, Lambert, Bing. Cherries do very well. PEACHES (Cultivated only in a few districts along the coast, and on a small scale, climatic conditions do not allow of a more general distribution): — *White varieties:* — Wadsworth, Belle of Georgia, Ray, Carman.

Yellow Varieties: — Fitzgerald, Captain Eric, Early Elberta. QUINCES (The same applies to these as to peaches) — Orange, Bogenhut, Champion. GRAPES (Grown for home consumption only): — Concord, Niagara, Worden, Moore Early, Lawrence, Catawba.

STRAWBERRIES (These give the largest yield of the small fruits): — *Biscuit Varieties* (self-pollinators): — Glen Mary, First Quality, Brandywine, Senator Dunlap, Uncle Jim, Nelson, Marshall, Ridgeway, Wm. Belt, Barrymore, Gibson, Helen Davis, Chesapeake, Pioneer, Superb, Progressive, (the last 2 are everbearing varieties).

Potential varieties (contain little or no pollen): — Sample, Bubach, Wooster. RASPBERRIES: — *Red Varieties:* — St. Regis, Cuthbert, Columbian, Herbert, Marlboro.

* denotes the varieties most suited to commercial production; ** denotes varieties recently found in commercial orchards and to be recommended when the environmental conditions are favourable.

Black Caps : — Cumberland, Gregg, Kansas.

Purple Canes (hybrids between red and black) : Golden Queen.

GOOSEBERRIES : — *Red Varieties* : — Industry, Red Jacket, Houghton.

Yellow Varieties : Dowling, Keepsake, Champion.

CURRENTS : — *Red Varieties* : — Cherry, Fay Prolific, Perfection, Red Cross.

White Varieties : — White Grape, White Imperial.

Black Variety : — Champion.

BLACKBERRIES : — Agawam, Eldorado, Taylor, Snyder, Waril.

638 - **Effect of Fertilizers on the Composition and Quality of Oranges.** — YOUNG, H. I. (Agricultural Experiment Station of the University of California). *Journal of Agricultural Research*, Vol. VIII, No. 4, pp. 127-138. Washington, D. C., January 22, 1917.

Of the great amount of work which has been done with fertilizers only a relatively small proportion deals with their effects on the quality of the crop. This is especially true of fruits, partly because of the length of time required, and partly because of the conflicting factors which enter into a long-time experiment. The material presented in this paper has to do with oranges (*Citrus aurantium*). The quality of this crop may offer an easier subject for study than most fruits, as the factors affecting it, such as the percentages of sugar and acid, the texture of the fruit as a whole (its specific gravity), and the proportions of juice and rind, can be accurately measured.

The University of California Citrus Experiment Station has maintained a continuous fertilizer experiment since 1907; the experimental area is composed of 20 plots with six trees each of Washington Navel oranges, Valencia oranges, Eureka lemons and Lisbon lemon in each plot; up to the end of 1914 the total amount of fertilizers applied to each tree had been approximately 6 lbs. of nitrogen and potash each, and 12 lbs. of phosphoric acid. A study of the quality and composition of the oranges was first taken up with the crop of 1914; a sample of 10 fruits was taken from each tree and a composite of these fruits taken for analysis, and the sample from one tree of each of the 20 plots was picked and analyzed on the same day.

The following is a summary of the main results arrived at: Nitrogen is the only fertilizer which in this experiment seemed to exercise a specific effect on the composition of oranges; applications of nitrogen to the soil resulted in a slightly lower amount of sugar, a somewhat coarser fruit and a little less juice in the orange; the effect of nitrogen was the same whether applied alone, in combination with either potash or phosphoric acid, or both. The effect of nitrogen was greater in 1915 than in 1914; as the crop was picked about two months later in 1915 it would indicate that some effect other than delayed maturity was caused by the nitrogen. Comparison with fruit from similar trees grown outside the fertilizer plots shows a fair agreement of composition and quality. The analyses show a higher percentage of nitrogen in the fruit from all plots receiving it, while no such effect was obtained with either phosphoric acid or potash.

Seven references to literature are cited.

- 639 - Experimental Work in Italy on the Plum (*Prunus domestica* L. var. *α-aeconomica*) and on the Composition of the Oil extracted from the Kernels. — FERUGLIO, D. and BERNARDIS, G. B., in *Bollettino dell'Associazione Agraria Friulana*, 61st. Year, Series VII, Vol. 31, pp. 56-75, Udine, December 31, 1916.

In the hilly region around Friuli, and in the neighbourhood of Gorizia, the cultivation of the plum (*Prunus domestica* L. var. *α-aeconomica* Borek) is of considerable importance. In the "Collio" region alone, at least 70,000 quintals (1 quintal = nearly 2 cwt.) of plums are dried annually, the quantity of dried fruit obtained being about 1 quintal per 5 quintals of fresh plums. The industry in dried plums, with skin and stone removed, which is a very paying one and gives work to a large number of farmers, is particularly developed in the Gorizia region. The sorts commonly cultivated in this zone have been used by the writers for their researches, which may be summarised as follows:

- 1) Average production per tree
- 2) Relations between different portions of the fruit
- 3) Composition of the fruit
- 4) Composition of the kernels
- 5) Composition of the stones devoid of their kernels
- 6) Composition of the leaves and branches produced during the year, and chief constituents of the ash
- 7) Preparation of oil from the kernels
- 8) Physical characters and constants
- 9) Chemical characters and constants
- 10) Qualitative researches upon the fatty acids.

The average dimensions of fruit and kernel are as follows:

	Fruit	Stone
Length	1.81 cm	2.31 cm
Width	2.75	1.20
Ratio length: breadth	1.38	1.92

Average production per tree. — Calculating on a productive period of 30 years, the average annual yield per tree is about 20 kg.

An average tree furnishes 4 kg. of fresh leaves, gathered towards the end of September.

The weight of young branches produced during the year and gathered at the same time as the leaves, reaches 3 kg. per plant.

Relation between the different parts of the fruit. — The average weight of ripe fruit, immediately after gathering, calculated on numerous lots, is 16.81 kg. per 1000 plums. The minimum figures were observed in 1912 and the maximum in 1913.

For 1000 fruits, the average weight of the stones is 0.810 kg. and that of their kernels 0.216 kg.

These figures give the following proportions:

Skin, pulp and juice	95.18 %
Stone without kernel	3.53
Kernel with-skin	1.29
	<hr/> 100.00

Composition of the fruit. — Analysis of the fruits at the time of picking has given the following minimum and maximum figures:

	In 100 parts of plums free of stone (skin, pulp and juice)
Water	83.00-84.00 %
Ash	0.34-0.45
Total Nitrogen	0.08-0.091
Crude protein (N X 6.25)	0.50-0.57
Crude fat (ether extract)	0.11-0.13
Reducing sugars (as invert sugar)	4.08-4.67
Non-reducing sugars (as saccharose)	5.41-6.20
Fibre	0.36-0.46
Pentosans	0.61-0.64
Acidity of juice (as cc. of normal KOH)	5.80-6.90 cc.

Composition of the kernels. — 100 gr. of dried kernels at 100° C. yielded from 24.81 to 26.81 gr. of crude protein and from 42.61 to 45.69 gr. of crude fat (1). Immediately after picking the kernels contain 20% of water.

The results of the above analyses, in conjunction with the composition of the leaves and branches produced during the year, have enabled the writers to calculate the annual quantities of nutritive substances removed from the soil; they are given in the following table:

	Quantity of nutritive elements removed per hectare of soil (equivalent to 300 trees) in kg.					
	Nitrogen	Calcium oxide	Magne- sium oxide	Potas- sium oxide	Phos- phoric acid	Sul- phuric acid
Plums (skin, flesh and juice)	4.86 kg	2.06 kg	0.90 kg	12.12 kg	2.94 kg	1.92
Stones	0.21	0.75	0.01	0.16	0.01	0.04
Kernels	2.58	0.31	0.17	0.48	0.75	0.12
<i>Totals for fruit</i>	7.65	3.12	1.08	12.76	3.70	2.08
Leaves	0.20	20.42	4.80	16.14	3.06	4.62
Branches	6.36	22.08	2.56	2.96	2.52	0.96
<i>Totals for leaves and branches</i>	6.56	21.50	7.36	19.10	5.58	5.58
<i>Totals (fruit, leaves and branches)</i>	14.21	54.62	8.44	31.86	9.28	7.66

(1) See also B. February 1917, No. 185.

The greater part of the nutritive matter is removed by the leaves and branches; the quantity removed by the fruit is much lower. The plum is less exacting in this respect than other fruit trees such as the peach, apple, etc. This explains its hardiness and its faculty for adapting itself to the majority of soils.

In districts where the plum is largely grown, the kernels might well be used for the extraction of the oil, the residue being employed as a feeding cake.

Numerous analyses made by the writers have shown that this oil is composed chiefly of the glycerides of oleic acid, those of linoleic acid and palmitic acid figuring in only a small proportion. Analysis has also shown the presence of a very feeble quantity of an unidentified phytosterin (vegetable cholesterolin).

The oil shows a certain number of constants which only differ slightly from those of olive oil, consequently on mixing it with this latter in a certain proportion its presence is not easily detected. Owing to its properties and organoleptic qualities, it can be put to various uses and may attain quite favorable prices on the market.

340 - **Shallow Cultivation in Vineyards** (1). — BUCHARD, P., in *La Vie agricole et rurale*; Year 7, No. 18, pp. 312-314, 4 fig. Paris, May 5, 1917.

In view of the ever-increasing difficulties of vine-growing in those countries engaged in war for nearly 3 years, shallow cultivation (*dry farming*, *culture Jean*, etc.) is now very generally adopted in vineyards.

If, instead of a plough, making a deep furrow, implements of shallow draught are used, the expense is much less, and the number of the necessary staff, horses, implements, together with the cost of their upkeep, are diminished.

The soil is not stirred to nearly so great a depth as with a plough, but it is possible to repeat the process frequently, which cannot be done when a plough is used. By this method grass does not have time to develop, nor the ground to harden; the arable layer gradually deepens, all traces of grass disappear, cultivation becomes easier and the plant grows more vigorously.

A detailed description of the implements required for the shallow cultivation of the vine is given.

Disc harrows, of Canadian origin, may be used as clod-breakers, cultivators and for fallowing. They are composed of spherical or conical disks fixed on two axes in the same horizontal plane; by adjusting these axes, greater or less pressure may be obtained.

Spring-tine cultivators raise the soil, thus breaking it up. The European form of this implement preserves the rigid frame of the scarifier, only replacing the ordinary stanchions by flexible pieces. For use among trees or vines it is advisable to fix two teeth outside the frame, so as to work as near to the trunks as possible without damaging them. For harder

(1) See B., 1914, No. 640.

(Ed.).

work the ordinary ends may be replaced by wide triangular blades, which answer the same purpose as those of the old type of cultivator. In America these tools are made with separate frames as well as with spring teeth. Some of these cultivators are mounted on a tilbury or tricycle, with a seat; others are made with frames in juxtaposition, at an invariable distance apart but capable of being displaced vertically in order to follow the rise and fall of the ground.

Mention is also made of the FROGER *combined machine for weeding, stirring up the earth round the roots of the plant and hilling up*, specially constructed for the cultivation of the vine. It consists of a frame with shafts for a horse, and can, therefore, be used for passages of any width. As it is very low it is possible to work beneath the branches, even when growth is fairly advanced. The frame is supported by two wheels by means of which the depth can be controlled. The stilts are fixed to the frame in front of the wheels by means of axles, and can be moved either horizontally or vertically and raised as the driver wishes. As the rectangular implement frame is connected with these stilts, when these are moved all the implements move simultaneously with them; they have a displacement of 12 inches on either side. This enables the machine to be driven with perfect security and greatly facilitates working at the sides, since, by means of the stilts, the direction may be corrected and the implement frame kept in the desired position. A great variety of instruments may be fixed on to this frame, picks, coulter with rigid or spring teeth, discs, or a vineyard plough.

This arrangement allows all the ground to be turned, including the intervening spaces on either side. When using this combination the plants must be very straight and regularly planted. If, however, a vineyard plough is fitted on to one side only, the work may be carried out with perfect safety among low, irregularly growing plants.

The following method of shallow cultivation has been used by Mr. GAVORY for many years in the Var district:

The superficial roots of the vine are left because, as they are in closer and more fertile soil, they feed the plant most efficaciously. It is, therefore, only necessary to scratch the soil in order to suppress weeds and to keep the ground fresh.

At the beginning of November, as soon as the grapes are gathered, the vines are pruned care being taken to keep the crown of the plant a sufficient height above the ground (about 14 inches), so that the hoe may pass close to the foot of the vine and that the frame may not be obstructed.

In December and January pruning is continued, the dead plants replaced and the superfluous American branches removed with a very sharp tool (*cissadoue*). This tool may be used by a woman and, with it, the very small space round the shoots may be stirred. The "*cissadoue*" is only used for vines with superfluous branches.

At the beginning of February hoeing is begun, and the work of scratching the soil continued till harvest time. Various blades are used on the hoe. In the first case spoon-shaped blades, which only scrape the earth, are used. Later, more or less flat triangular shares are fixed. These cut the earth to a greater depth which, however, never exceeds a couple of inches.

11 - **Cultivation of the Vine by the Desbois Method.** — GRANDCLÉMENT in *La Vie agricole et rurale*, Year 7, No. 18, pp. 316-317, Paris, May 5, 1917.

The DESBOIS method of vine cultivation consists essentially of 3 things:

- 1) *Retention of the fruit and wood shoots* throughout their whole length, and ringing off the eyes occurring beyond the 8 or 10 which are kept for fruit and the 2 left for wood. This method gives double the quantity of sap for the eyes that are retained than the usual method of pruning, which simply severs the branches beyond these buds. There is, therefore, no ground for surprise if, having received double nourishment, the future branches have double the quantity of wood and bear a double amount of leaves and grapes. Removal of the eyes is the new and essential point of the DESBOIS method.
- 2) In summer repeated ringing of the terminal bud of the fruit branches is effected, an operation which increases the effect of the winter removal of eyes; it accumulates a further quantity of sap in the leaves and fruits of these branches which would otherwise go towards strengthening the branches and producing a useless quantity of wood.
- 3) The third point is the most important and is distinctly original: it consists in the retention of the fruit branch for 3 years in succession. This branch, which is only in the herbaceous state in the 1st. year, reaches in the second year a markedly woody condition resulting in very strong, well-lignified roots which the phylloxera are unable to penetrate, and which, consequently, are obliged to go deep down into the soil to obtain their food. During the 3rd. year these roots become still stronger, thanks to the retention of the fruit branch, which remains live for a good portion of the summer in spite of having been deprived of all its buds and branches. — The next 3-year cycle in turn reproduces roots producing magnificent fruiting canes.

There is nothing to prevent, in addition to all these operations, the practice of *ringing*, effected before the flower appears, towards the base of the fruit branch. This will still further increase the quantity of leaves and fruit. These combined operations will prevent the fruit from dropping, etc. Fungoid diseases will be held in check much more efficiently with two or three sulphurings only, the first one always being made very early, at the beginning of May, and a single treatment of the flowers effected with a finely powdered mixture of sulphur and lime. M. DESBOIS attaches considerable importance to lime for preserving the flower and keeping it healthy.

This system does not imply any absolute necessity for the vines to be trained along wires at a height of 2 metres; it can be made to apply to such vines as those of Beaujolais for instance, which only have low props. It suffices to follow the method as far as possible, not to copy it minutely. While retaining the props, an endeavour should be made to keep the aerial portions of the plant as long as possible, by keeping each of the three branches which bear 2 eyes at their full length, and removing all the eyes occurring above the 2 retained at the lower end, up to a height corresponding to the point of the prop.

In this way the production will be doubled in the first year of the 3-year cycle. The second year the branch, which has now become woody, can be retained and attached to the prop, and on it there can be left 2 shoots pruned to 3 eyes, the third one now being removed. As it grows older and becomes stouter, this branch will support the prop and may even replace it, a point which may be of considerable advantage. It can be retained

for several years until it can be replaced by a new fruit branch which has withered in its turn.

By means of the DESBOIS system, properly applied, vines may be kept indefinitely with the minimum expense and labour.

M. DESBOIS has a special method by which he can obtain plants, with extraordinarily strong root development, capable of producing half crop in the first year of their final planting. The method, called *transusio* of sap, is as follows:

At pruning time, he selects, aside from those which are to act as carriers, one or more shoots from a fine stock; these shoots should be at least 1 metre long. A little time before the awakening of growth, by means of a wooden stake or peg, along the line of the stocks about 30 or 40 cms. from the mother stock, he makes a hole deep enough to introduce in an upright position the extremity of the shoot, the length of which should not exceed 4 eyes, in such a way that the 4th. eye, viz. the one nearest the surface of the soil, should be about 6 to 8 cms. below the latter.

The extremity of the shoot is fixed at the bottom of the hole, leaving the three eyes buried in the earth at the bottom, the *fourth eye* being, with the utmost care, allowed to remain free 6 to 8 cms. below the soil surface.

When the buds begin to swell, all the eyes of the shoot so bent back are suppressed, with the exception of the two nearest the stock and the one which is to give rise to the subject (fourth). When the little stem of this latter begins to project above the soil surface it should be covered with a thin layer of earth. When it has reached a length of 30 cms., the growth of the young subject should be stopped by suppressing the terminal eye of the shoot which is to form it. This operation of ringing the terminal eye of the little stem will occasion at that point the formation of a collar or vital node which will give rise, like a seed, to a complete root system, which in its first year will give off tap-roots of very great vigour. The plants with these roots, detached from the mother stock, may be finally planted in the autumn of the same year. They will give a half-crop the first year and a nearly full crop the second.

642 - Observations on the Cultivation of the Vine "en Asmas", in Bulgaria. -- See No. 697 of this *Bulletin*.

643 - Influence of the Perennial Lupin on the Development of Forest Trees. -- TRIEB in Bohemia. -- NAWRATH, K., in *Centralblatt für das gesamte Forstwesen*, Year 12, Parts 5-6, pp. 178-180, Vienna, 1916.

Fifteen years ago, in the forest district of Haid (Western Bohemia), the writer began an experiment to test the influence of the perennial lupin (*Lupinus perennis* L.) on the development of forest trees in mediocre soils. Two plots were planted with spruce, one with and one without lupin.

Later, it was evident that the plot with lupin was making stronger growth than the other: thus, 10 years after planting (1911), the trees in the lupin plot were 1.63 metres high against a height of 1.02 m. only for those in the plot without lupin; both lateral branches and needles of the former were longer than those of the second plot. These differences were confirmed during the period 1911-1916. The accompanying Table summarises the observations made upon this subject.

The excellent effect of the perennial lupin would be due to the following causes :

- 1) In mediocre soils, the lupin ensures retention of moisture and of the chief fertilising elements indispensable to young plants.
- 2) The lupin enriches the soil in nitrogen.
- 3) Thanks to its rapid growth, it quickly covers the soil and clears out weeds, especially heather; by employing 12 to 20 kg. of lupin seed per hectare, the soil is well covered in 2 to 3 years.

Differences observed between spruce trees on plots with and without lupin.

	Average lengths of annual shoots of lateral branches		Average lengths of needles	
	Plot without lupin 9 trees	Plot with lupin 8 trees	Plot without lupin 10 trees *	Plot with lupin 8 trees **
	31 mm.	110 mm.	7.6 mm.	14.8 mm.
	36	110	6.4	11.8
	42	110	7.4	13.3
	36	96	11.9	12.3
	28	84	8.7	14.1
	20	90	8.6	12.8
	25	97	8.1	12.8
	20	95	7.4	12.0
	11	---	7.7	---
	---	---	8.5	---
<i>General averages</i>	31 mm.	100 mm.	8.2 mm.	13.1 mm.

* Needles faultily developed, colour varying from light green to yellow.

** Needles well developed, dark green colour.

LIVE STOCK AND BREEDING.

614 - Anaphylaxis in Cattle and Sheep, Produced by the Larvae of *Hypoderma bovis*, *H. lineata* and *Oestrus Ovis*. — HADWEN, SEYMOUR and BRUCE, E. A. in *Journal of the American Veterinary Medical Association*, Vol. LI, New Series, Vol. 4, No. 1, pp. 15-44, 15 plates, Ithaca N. Y., April, 1917.

Anaphylaxis has been described by MUIR and RITCHIE (1910) as development under certain circumstances in an animal of hypersensitiveness to foreign albuminous materials which in themselves are not essentially toxic. The common feature is that repeated injections of certain substances in sub-toxic or non-toxic doses — a suitable interval of time elapsing between the injections — may be followed by markedly toxic or even fatal symptoms. The writers have obtained such reactions in cattle,

sheep and small animals by injecting them with extracts of the larval forms of *Hypoderma lineata*, *H. bovis* and *Oestrus ovis* from their own bodies. They have also observed natural cases of anaphylaxis where, owing to injury, the larvae have been ruptured subcutaneously *in loco*. As extracts of *Hypoderma* larvae contain little or no toxic material the reaction is regarded as being due to the development of hypersensitiveness in the host to the protein material of its parasite.

Anaphylaxis may be either "acute" or "chronic". The symptoms in the first case were immediate, the first noticeable sign being an extremely tired look, succeeded almost immediately by salivation, tears and defaecation, then by signs of asphyxia and death. In the "chronic" form the symptoms were a little less rapid and not so severe, in addition there were oedemas, especially of the eyelids and anus, and marked irritation of the skin.

Small animals were sensitized with warble extracts and showed signs of anaphylaxis following the second injection.

Eye and other local reactions were obtained with extracts applied to the mucous membranes. In cattle the reaction was specific for extracts of *Hypoderma*, and in a horse for *Gastrophilus*.

It would appear probable that similar reactions will be obtained in other animals with their own parasites.

645 - A Study of Hemorrhagic Septicaemia, Observations in Sheep and in Mouflon-Sheep Hybrids. — MORI, NELLO (Director of the Naples Experimental Station for Infectious Diseases of Livestock) in *Annali delle Stazioni Sperimentale per le malattie infettive del bestiame*, Vol. III, part II. 33 pp. Naples, Year 1916.

The clinical nature of Hemorrhagic Septicaemia of sheep has been known for some time past but owing to association in many cases with worm parasites of lung and stomach its true nature is often mistaken. The present study is based on material from the Naples Veterinary School and other districts of S. Italy.

SYMPTOMS AND ANATOMICAL LESIONS. — Animals listless, somewhat disinclined to eat, marked oscillations of temperature, discharge from nose, cough, faeces soft but no actual diarrhoea, limping (preferably hind limbs affected). Later, anaemia rapidly becoming very serious, with progressive loss of weight.

The disease generally required 15-25 days to run its course; in some cases 2-3 months and affected Abyssinian sheep, merinos and mouflons.

Mucous surfaces of shining white appearance, resembling porcelain. gelatinous subcutaneous exudates in relation with lymphatics of inguinal region, in some cases signs of intestinal catarrh; the liver might or might not show lesions from flukes. No Strongylids were found. Frequently serofibrinous pleurisy phenomena and almost always foci of pulmonary inflammation with sero-gelatinous infiltrations sometimes extending over the entire lung apex which as a result took on the appearance of a piece of amber.

In the pericardium was frequently found a lemon-coloured or sero-hemorrhagic exudate, occasionally a gelatinous exudate surrounding the

heart, especially about the auricles; upon the wall of the pericardium occurred more or less numerous ecchymoses, these were also noticed in some cases upon the endocardium.

The blood was thin. In some cases signs of bronchial catarrh were seen; the peribronchial ganglia of a reddish tinge and in such cases surrounded by a gelatinous exudate. In one case of an Abyssinian goat polyserosity was observed.

The above account corresponds to a subacute and a chronic form of the disease. There is also an apoplectic and an acute form, the former ending fatally in a few hours, the latter accompanied by nervous phenomena and distinct symptoms of pleuropneumonia.

LOSSES DUE TO THE DISEASE. — These are fairly high. At the Naples Institute 12 sheep died out of a total of 25. Apart from death loss occurs from impaired milk yield, abortion and marked diminution in weight.

ETIOLOGY. — The cause of the disease is a polymorphous bacterium resembling that causing hemorrhagic Septicaemia in other animals.

BACTERIOLOGY. — The following is a summary of the chief characters of the specific bacterium.

Non-motile. Markedly polymorphous; ovoid, isolated or united in short chains when derived from tissues of sick animals whether sickness occurred naturally or was produced artificially; but assuming different forms in artificial culture media. **GRAM** positive. Acid-resistant neither to the ZIEHL-NEELSEN nor to the ZIEHL-MORI method. No cilia. No definitely colorable capsule though in organic juices shows a distinct halo. Non-sporing.

Cultural Characters. Preferably aerobic. Optimum development at 37-38° C. Grows well in an alkaline medium but can accustom itself to neutral or slightly acid media. Gelatine not liquefied. No growth on potato slopes.

Biochemical Characters — No acid, no alkali in neutral broth. In peptonized broth formation of H_2S in 24 hours. Positive, though feeble, reaction with SALKOWSKI'S, GRIMBERT'S and CRISAFULLI'S method (Indol test) Reduces nitrates. Does not secrete trypsin. Does not coagulate milk. Tryptophane reaction negative. No effect on saccharose, mannite, dextrin, glycerine and rice starch.

Conservation of vitality and virulence. Broth and agar cultures at room temperature have retained their vitality for 65 days. Infected blood in flame-sealed capillary tubes kept at room temperature gave evidence of vitality up till the 5th. month. Cultures in broth and agar transplanted to the same media every 30-40 days, retained their initial virulence practically intact for 8-12 months.

Resistance to Dessiccation, Sunlight and Heat. — Germs dried on wood, silk and platinum were dead after 8 days, on linen they resisted till the 10th day, on wool till the 12th, on blotting paper till the 18th day.

Extremely thin films of 2 day-old broth cultures on glass cover slides were filtered, dried, placed with the usual precautions in closed Petri dishes

and exposed to the direct rays of a July sun at midday. Two to three minutes were invariably sufficient to kill the germs.

Broth cultures (24 hours) were closed in extremely thin capillary tubes and immersed in the water bath. 5 minutes at 55° C. were always sufficient to kill the germs; and 10 minutes at 50° C. nearly always so.

Inoculation Experiments.— The account of these is given in detail. Results varied.

Agglutination tests.— Proof was obtained of the agglutinability of strains of bacteria of hemorrhagic Septicaemia of other animal species through the agency of the immune-serum prepared with *B. ovissepticus*.

This is evidence of the mutual relationship and justifies the interpretation that they are to be regarded as races of a single bacterium derived through acclimatisation in organisms of another species.

Treatment and Prevention.— LIGNIÈRES (*Boletín del Ministerio de Agricultura*, Vol. VI, Nos. 1, 2 and 3, Buenos Aires, 1906) has evolved a treatment based upon the employment of various antiseptic and vermifugal substances, i. e. creosote carbolic acid and naphthaline with camala and aqueous or ethereal extract of male fern, owing to the fact that worms are often associated with this disease.

As regards preventive methods, care should be taken not to introduce sick animals into the flock: often infection is derived from apparently healthy reproducers. No animals should ever be bought showing nasal discharge, whether from an infected region or not. Flocks should be allowed plenty of room. If the sheep are folded the food should be derived from healthy, dry localities; if at grass, damp low-lying pastures with stagnant water should be avoided. Drinking water must be from a perfectly healthy source. Where disease has already entered the flock, the pasture should be changed or, at least, the sick animals isolated.

LIGNIÈRES has prepared a polyvalent vaccine with 6 strains of bacteria of hemorrhagic Septicaemia which he claims is an efficient preventive. MESSNER and SCHERN, RAEBIGER, KLIEN and SEIBOLD have also prepared sera which have given encouraging results. Cases are also to hand where the specific treatment for symptomatic anthrax has been successful in arresting hemorrhagic Septicaemia. The writer appends to his paper a bibliography containing 14 references.

646 - An Intradermal Test for *Bacterium pullorum* Infection in Fowls.

WARD, ARCHIBALD R. and GALLAGHER, A., in *U. S. Dept. of Agriculture, Bulletin No. 617*, 15 pp., Washington, February 16, 1917.

Of the numerous diseases to which poultry are susceptible it is safe to say that bacillary white diarrhoea is the most destructive. Its ravages are confined principally to baby chicks, but it is the *pullorum* infection in the hen which is directly responsible for out-break of white diarrhoea in the chicks, since a certain percentage of her eggs hatch infected chicks and the excrement of these spreads the disease to the other birds in the brood. The exceedingly high mortality of white diarrhoea, amounting in some cases to almost 100 % of the hatch, practically prevents the rearing of

chicks in infected flocks. Chicks which recover may carry the causative bacterium in the ovary and serve as a source of infection in the future. Infected hens usually exhibit an ovary containing several angular, hard, discoloured ova; however, the organ may continue to function and from time to time an ovum is released which harbours the infective agent. Outbreaks of white diarrhoea as a result of contaminated incubators or brooders could be controlled readily by sanitary measures, but infection through the egg must be prevented by eliminating the infected birds.

As the presence of *Bacterium pullorum* in the ovaries is not revealed by any external symptoms, it has been necessary to have recourse to the biological method in order to diagnose the disease and it has been shown that the agglutination test may be so employed; however, the cost of this latter is relatively too expensive. The writers have therefore investigated a simpler method of diagnosis, less costly, equally accurate and very similar to the hypodermic tuberculin test.

Among the different biological products obtained from *Bacterium pullorum*, the one which gave the most satisfactory results was a broth culture of the bacterium kept for 1 month at 37° C., filtered and sufficient carbolic acid added to make a 0.5 % solution. This culture was tested on the fowls both in the laboratory and in the open.

It seems to be a fact that the edematous swelling resulting from the injection of the product into the wattle of a fowl, when observed at a proper interval of time, is an indication of the presence of infection of *B. pullorum* in the fowl.

The experience of the authors to date, with readings at various intervals of time, leads to the conclusion that the 24 hour interval has given the most accurate results. However, it seems desirable to test on a large number of birds the accuracy of readings made at a slightly longer interval.

The weight of evidence indicates that any perceptible swelling of the wattle should be regarded as significant. A second intradermal test made at an interval of 4 days gave results varying but little from the first test. Others made at intervals up to two months gave less accurate results the second time. Thus, there is no advantage in retesting.

Of birds artificially infected with the disease and tested in the laboratory, in round numbers 90 % gave positive reactions; and in 6 % the test failed to indicate a reaction when lesions were present. In 3 % no reaction occurred and no lesions were present.

In a field test on 231 birds made simultaneously with the agglutination test, the intradermal test at 38 hours failed to detect one case reported positive to the other test. In a second flock of 50 birds in which the two tests were compared, the intradermal test when read at 46 hours failed to indicate one case that was detected by the agglutination test. Another group of about 100 birds tested under unfavourable conditions gave less satisfactory results.

Forty-seven birds that had been tested by the agglutination method by the Connecticut Agricultural Experiment Station in the field were purchased for experiments with the intradermal test. Of these, 40 had given

positive reactions to the agglutination test and 7 doubtful reactions. There was complete agreement between the agglutination tests, the intradermal test, and autopsy findings in 70 % of the cases. The agglutination test reported positive in 3 cases, or 7 %, and was not confirmed by the intradermal test nor by the autopsy findings. Thus the percentage of absolute failures of each test was small, and very similar for both tests.

Autopsy does not furnish an absolute standard for comparing the accuracy of tests. 72 % only of naturally infected birds that had reacted to one or both tests were found on autopsy to be unmistakably infected.

The intradermal test detected the presence of infection in 4 of the 3 control birds injected in connection with the tests in the laboratory on artificially and naturally infected birds.

In a field trial not made by the writers, 1301 birds were tested intradermally and 78 reacted. Of these 70 reacted to the agglutination test made subsequently.

The intradermal test has already shown sufficient promise to warrant further extensive trials in the field in comparison with the agglutination test.

647 - Relation between the External Body Measurements, the Live Weight and the Net Weight on the One Hand, and the Weight of the Heart and the Lungs on the Other Hand, in Cattle of the Schwytz and Parmesan Breeds; Investigations carried out in Italy. — BRENTANA, DOMENICO, in *Il Moderno Zootrofo*, Series V, Year VI, No. 3, pp. 61-79, Bologna, March 5, 1917.

The modern works on the relation between the body measurements, live weight, etc. on the one hand and the weight of the heart and the lungs on the other, in domestic animals and in man, are summarily reviewed. The author then describes his own experiments at the public abattoir of Parma on 84 cattle, giving, in 4 tables, the results of his measurements and calculations. The minimum, maximum and average figures obtained are summarised in the appended table. The author came to the following conclusions:

1) The total weight of the lungs and heart tends to increase with the increase in live weight, but is not proportionate to this latter, which increases more rapidly, especially in relation to the weight of the lungs. This fact is further demonstrated by the progress of the relative weights of the heart and the lungs, which tend to increase as the live weight decreases.

There is also a certain relation between the increase in weight of the heart and that of the lungs.

2) The relation between the proportionate produce at slaughtering and the weight of the lungs and the heart is not very clear. BAUDEMENT's theory that, all else being equal, the relative weight of these organs is lowest in animals in best condition, seems nevertheless to be confirmed.

3) The constancy of the ratios

$$\sqrt[3]{\frac{\text{weight of lungs}}{\text{live weight}}} \times 100 \quad \text{and} \quad \sqrt[3]{\frac{\text{weight of heart}}{\text{live weight}}} \times 100$$

	Schweitz Cows			Schweitz Bulls			Farmsman Cows			Farmsman Bulls		
	Average	Maxi- mum	Mini- mum	Average	Maxi- mum	Mini- mum	Average	Maxi- mum	Mini- mum	Average	Maxi- mum	Mini- mum
Live weight	495	670	360	670	790	640	485	560	400	612	760	480
Weight of lungs	340	420	220	500	600	400	450	520	300	490	580	430
Weight of heart	230	290	180	340	380	280	250	290	190	340	380	250
Net weight	250	370	200	320	380	280	280	340	200	340	380	250
Grammes of lung per 1 kg. of live weight	15.25	19.40	10.80	13.55	15.80	11.80	13.80	15.80	10.65	15.80	18.60	13.05
Grammes of heart per 1 kg. of live weight	4.00	5.60	4.30	4.55	5.60	3.80	5.30	5.90	4.50	4.80	5.35	4.35
Height of withers	9.50	11.50	7.70	7.95	9.30	6.70	10.85	12.10	8.70	9.00	10.15	8.00
Relative index of lungs	131	135	120	146	157	136	137	140	126	149	154	142
Relative index of heart	12.00	13.40	11.60	11.60	12.50	10.90	12.68	12.82	11.31	12.15	12.86	11.85
Size of thorax	10.10	11.50	8.60	9.00	9.70	8.10	9.30	9.35	8.70	9.35	10.40	8.90
Relative index of lungs	33.40	40.20	28.00	32.20	38.40	26.60	38.30	41.40	36.40	34.70	41.50	31.00
Relative index of heart	28.60	32.50	23.10	27.20	31.60	21.70	31.90	34.00	27.80	28.60	34.50	26.60
Height of thorax	68	75	62	77	82	72	79	73	66	77	84	75
Relative index of lungs	23.40	25.10	21.30	22.10	24.00	21.10	23.65	25.50	22.00	22.10	24.00	20.65
Length of trunk	10.90	12.70	10.00	11.70	13.60	10.80	12.30	13.30	10.50	12.70	13.90	10.30
Relative index of lungs	167.40	184.50	153.70	179.60	198.30	160.00	179.60	188.50	160.00	179.60	198.30	160.00
Perimeter of thorax	8.00	8.60	7.00	8.05	8.90	7.40	8.90	9.60	7.30	8.40	9.00	7.70
Relative index of lungs	191	215	175	216	235	200	203	198	177	212	225	200
Weight of lungs	4.04	4.80	3.40	3.85	4.25	3.60	4.45	4.80	3.60	4.10	4.80	3.70
Live weight												
Weight of heart	2.90	3.20	2.20	2.72	3.15	2.45	3.04	3.30	2.75	2.84	3.05	2.75
Live weight												
Yield at slaughtering	51.5	56	45	57	61	54	49	50.00	45.60	55.80	58.50	47.50

is of interest ; it is much greater than the ratio observed between the live weight and the weight of the heart and the lungs. This corresponds with the observations which have been made concerning organic combustion as compared with the weight and surface of the body ; according to LAULANIE, all else being equal, the intensity of combustion increases more slowly than weight, following the increase in surface very closely.

4) With regard to differences in the various breeds and in sex, the average observations show that, in the Schwytz breed, the total weight of the heart and lungs is greater in bulls than in cows, whereas, in the latter the relative weight is greater. Similar differences occur between bulls and cows of the Parmesan breed. As compared with Schwytz bulls, Parmesan bulls show a smaller total weight of the heart and the lungs, and a greater relative weight of the same organs. Parmesan cows show both a greater total weight and a greater relative weight of the heart and the lungs than Schwytz cows.

If, instead of the averages, comparison is made between the absolute and relative weights of individuals of about the same live weight, it will be seen that these are greater in the Parmesan than in the Schwytz breed ; as regards sex, the total and relative weights are greater in the males than in the females. These observations, on the one hand, confirm the theory that the heart and lungs tend to increase with the live weight, and on the other hand, they correspond to the different capacities of the Schwytz and Parmesan breeds and the greater fitness of the latter for work. The differences between the sexes may be considered analogous to the intensity of the respiratory exchanges which, other things being equal, are greater in the male.

5) As a rule, the heart indices are more constant than the lung indices. The indices with the greatest constancy are those relating to the length of the trunk and the thoracic perimeter.

648 - **The Mineral Metabolism of the Milch Cow.** — FORBES, B. and BEEGLE, F. M., in collabor. with FRITZ, C. M., MORGAN, L. E. and RICE, S. N., in *Ohio Agricultural Experiment Station Bulletin No. 245*, pp. 324-338, Wooster, Ohio, April 1916.

The dairy cow greatly exceeds any of the other farm quadrupeds in the rapidity and efficiency with which she produces proteid and mineral nutriment. Her unusual requirement for protein in the ration is universally recognized and receives that attention which its importance demands.

The mineral requirements of the milch cow, however, have received but scant recognition. In the literature there is almost no evidence on the subject, and it is ordinarily assumed that cows get enough mineral matter in the ration at all times. The results of this experiment on the mineral metabolism and requirements of milch cows show that this assumption is not right.

The mineral income and outgo of the milch cow was studied on common practical rations, especially as influenced by the protein concentration and by the type of roughage fed.

The rations fed were the following :

Corn, cottonseed meal, timothy hay, corn silage,

Corn, cottonseed meal, clover hay,
Corn, cottonseed meal, clover hay, corn silage,
Corn, distiller's grains, clover hay, corn silage,
Corn, linseed oilmeal, clover hay, corn silage,
Corn, gluten feed, clover hay, corn silage.

These rations afforded a basis for the comparison of clover and timothy hay, and of the common commercial nitrogenous concentrates.

The investigation was conducted during January, February and March 1915, by the usual method of the metabolism experiment, involving the collection, sampling and analysis of food, urine, faeces and milk.

Six cows were purchased for this investigation. Five of them were Friesians, and one was pure-bred. The cows were from 3 to 5 years of age, and all were fresh from 4 to 6 weeks before the experiment began.

After a preliminary feeding of 3 weeks to accustom the cows to the ration, the rations and the routine, the experiment began on January 8. The experiment covered three collection periods mostly of 19 or 20 days' duration, separated by 10 day intervals on the feed of the next period to allow the changes in the rations being made abruptly at the beginning of the intermediate periods.

The records taken during the experiment were the following: the average daily amounts of foods consumed; the milk produced; the live weights of the cows; the composition of foods and milk; the amounts of the several constituents of the rations, milk, urine and faeces; the average daily amount of each of the constituents determined in the food, milk, urine and faeces, and the final balance of income and outgo for each; the computation of the mineral acids and bases of the food-stuffs to cubic centimeters normal solution of the respective elements; the relation of urinary ammonia, phosphates and sulphates to the balance of mineral acids and bases of the rations, and the coefficients of digestibility of the rations.

The balance data summarized in the appended table, show that the intake of common salt, about 1 ounce per head per day, was usually sufficient along with the sodium and chlorine of the rest of the ration to maintain sodium and chlorine equilibrium, though there were 4 negative sodium balances and 5 negative chlorine balances out of 18 of each.

Of the potassium balances 5 out of 18 were negative. Without exception there was a loss of calcium and magnesium, and in 15 cases out of 18, a loss also of phosphorus.

The results show that there was with each cow, on every ration, a retention of nitrogen, and in all but 2 cases out of 18 a retention of sulphur, these facts indicating that the rations provide nutriment sufficient in amount, and of the right kind to protect and to increase the protein tissues of the cows. This condition, taken in connection with the fact that all the cows but one gained in weight, shows that the losses of calcium, magnesium and phosphorus were not due to general under-nourishment, but that for some unknown reason the animals were obliged to draw upon their skeletons in the production of milk.

The balance data also demonstrate the existence of an extensive metabolism of silicon, the retention of this element from the first ration, which contained timothy hay, being surprisingly large. This storage of silicon may have taken place through the growth of hair, the ash of which contains silicon in considerable quantity. No silicon was found in the milk, but quantities of it were found in the urine.

From these results it appears that failure to maintain mineral equilibrium must be so common among cows of the more profitable sort that it must be considered a normal condition during the time of larger production, at least if this occurs during the winter, that is, while the cows are not on pasture. The writers are led, therefore, to look for results of such losses, in the behaviour of cows under usual methods of management.

The effects of these losses are observed most noticeably under the conditions which tend to accentuate them, thus malnutrition of the body is common in regions of unfertile sandy soils, or soils of granitic origin, especially if these be worn through long cropping with insufficient fertilization, and also after seasons of drought, overstocking of pastures and deficient food supply.

It is not necessary, however, to go into the field of pathology for instances of the practical bearings of the main point determined by this investigation. Under the best conditions of feeding and management understood by practical feeders, a cow often fails to breed during the season following one in which she has been fed for a record of high production. It seems quite probable that the excessive lactation has depleted the mineral reserves of the body to such an extent as to disturb the reproductive functions. Such a depletion is also reflected in the fact of the failure of many cows fed for high production to maintain high records during consecutive periods of lactation.

In all probability the most important results of a failure of heavy milking cows to maintain mineral equilibrium are not in such pronounced effects, but in an inconspicuous shrinkage of lactation in cows which are apparently in normal condition. Since milk production, in cows such as were used in this experiment, seems to be sustained in part by drawing upon the body reserves, and since this process cannot continue indefinitely, and since there is in cows a gradual shrinkage and final cessation of milk production coincident with this depletion of nutrient reserves, it is believable that this exhaustion of reserves should be among those factors which cause the gradual shrinkage of milk flow, and that by preventing as largely as possible these losses from the body the shrinkage may be lessened and the duration of the production of milk extended. The time of replenishment of reserves comes, of course, during the latter part of the period of gestation. This process of repair is most efficiently accomplished while the cows are on pasture, particularly if the pasture contains a considerable proportion of leguminous vegetation.

These balance data also indicate that after a certain level is reached in food consumption and milk production, the digestion of the additional mineral nutriment demanded by further increase in milk secretion

Cow No.	Period and days	Rations (Pounds)	Milk yield lbs.	Gain or loss to the body. (Grams)											
				Live weight	Sodium	Potas. alum	Calcium	Magne. alum	Sulphur	Chlorine	Phos. phorus	Silicon	Nitro- gen		
1	I 10	Corn 9.37; cottonseed meal 1.56; timothy hay 7.68; corn silage 21.00; malt 0.002	40.58	—	78.5	2,313	1,338	28,031	2,069	3,614	—	4,490	4,661	15,617	11,485
2	I 10	Corn 9.45; cottonseed meal 1.23; timothy hay 7.68; corn silage 30.05; malt 0.002	38.55	—	771.4	3,861	4,272	17,083	2,904	2,531	1,697	%	0.113	19,150	31,274
3	I 10	Corn 9.32; cottonseed meal 1.74; timothy hay 11.09; corn silage 15.00; malt 0.051	41.77	—	800.0	8,003	3,900	18,788	4,830	2,080	1,610	2,531	24,915	24,915	19,191
4	I 10	Corn 9.33; cottonseed meal 1.80; clover hay 8.99; malt 0.056	31.67	—	0.0	0.118	5,749	12,039	1,258	0.141	0.999	1,593	0.045	50,915	50,915
5	I 10	Corn 9.99; cottonseed meal 1.80; clover hay 8.99; malt 0.056	31.65	—	360.0	0.375	4,180	18,114	2,767	0.201	0.841	2,426	1,135	11,417	11,417
6	I 10	Corn 9.99; cottonseed meal 1.80; clover hay 8.99; malt 0.056	33.97	—	240.0	1,305	0.460	16,185	2,969	0.577	2,597	3,384	0.101	8,679	8,679
7	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	40.70	—	100.0	8,760	2,020	11,599	6,529	0.386	0.536	0.914	5,884	20,073	20,073
8	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	36.34	—	480.0	0.401	2,874	94.33	4,025	0.519	0.940	1,801	4,731	20,760	20,760
9	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	41.02	—	153.0	5,000	3,664	95.17	5,039	0.242	1,872	2,534	4,959	43,599	43,599
10	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	31.58	—	187.0	4,865	0.136	17,506	4,068	2,135	1,557	1,866	3,740	9,894	9,894
11	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	33.74	—	440.0	2,360	0.020	17,108	4,271	0.750	1,557	1,866	3,740	9,894	9,894
12	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	33.08	—	7.0	2,445	1,805	17,334	4,959	0.941	1,557	1,866	3,740	9,894	9,894
13	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	30.15	—	337.0	0.387	2,142	14,028	5,023	0.344	1,666	1,837	3,544	5,664	5,664
14	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	31.37	—	620.0	3,093	0.474	14,185	5,162	0.913	1,666	1,837	3,544	5,664	5,664
15	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	40.69	—	200	2,116	1,027	11,555	2,044	0.715	0.235	1,867	12,445	9,124	9,124
16	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	31.91	—	360.0	12,875	1,076	11,038	9,981	1,537	0.081	0.156	5,068	2,887	2,887
17	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	31.07	—	553.0	20,941	0.514	16,784	3,886	1,471	1,426	2,224	4,600	9,449	9,449
18	I 10	Corn 9.61; cottonseed meal 2.20; clover hay 10.00; malt 0.061	33.60	—	433.0	20,702	8,832	11,023	5,990	0.331	1,205	4,127	9,664	9,664	9,664

accomplished at such a decreasing rate of efficiency, that the only practicable method of meeting mineral requirements is through the destruction of bone tissue. This overdraft should then be made good as soon as practicable and a liberal supply of foods which are rich in these elements should be allowed after the cow has ceased to produce abundantly, during the latter part of the period of lactation, in order to refund previous overdrafts before the birth of the next calf. The further study of this problem is now under way.

No important specific effects were observed of the nitrogenous concentrates, cotton seed meal, linseed oilmeal, gluten feed and distiller's grains, on the digestibility of the rations in which they were fed.

649 - **By-Products from the Manufacture of Tin Plate** — *The Board of Agriculture of Ohio*, Vol. VII, No. 4, pp. 65-66. Columbus, Ohio, Nov., 1917.

In the process of preparing tin plate for market it is necessary to subject the plate to a scouring action which is accomplished by the use of some cereal middlings (usually wheat) and palm oil. Until the last three or four years this mixture of palm oil and wheat middlings was discarded after it had served its full purpose in the polishing machine, but it having been discovered that animals ate it with relish and with profitable results, it has now been added to the list of commercial feeds and is being sold in the United States as "Palmo Midds". As originally manufactured, the mixture from the polishing machine was merely sifted through a sieve by hand labor and that passing put on the market. This process having proved ineffective in removing slivers, slugs, splashes, etc., a special automatic electro-magnetic separator was designed. Results of an investigation recently completed by the Indiana State Chemist's Laboratory confirm the belief that with the new process of manufacture the deleterious material heretofore found in refuse cleaning will be removed and that this product will become a valuable addition to American concentrate food stuffs.

650 - **A Contribution to the Bacteriology of Silage.** — SHERMAN, J. M. (Bacteriological Laboratories of the Pennsylvania State College and Agricultural Experiment Station). *Journal of Bacteriology*, Vol. I, No. 4, pp. 445-451. Baltimore, 1916.

The fermentation which ensilage undergoes during its curing process was looked upon a few decades ago as being entirely of microbic origin; at the present time, opinion has swung in the opposite direction to such an extent that micro-organisms are now generally considered of little, if any, significance in the normal fermentation of silage.

The notes recorded in the present paper have been made on ensilage during 1915 and suggest the probable importance of a group of acid-tolerant, acid-producing bacilli in the curing of corn silage. The organism concerned, while closely related to the *Bacillus bulgaricus* group of milk and the *B. acidophilus* group of the intestines, appears to differ somewhat from the typical members of these groups, notably by its comparatively abundant growth on ordinary laboratory media.

• The microscopic examination of silage juice demonstrates the pre-

sence of immense numbers of bacterial cells (always over one billion per cubic centimeter), most of which are bacilli which resemble morphologically the high acid producing bacilli described above. The aciduric bacilli of silage are constantly found in quite large numbers on corn fodder, so that silage made from corn is always amply seeded with these organisms.

A bibliography of 17 references is appended.

551 - **Effects of Feeding Cottonseed Products on the Composition and Properties of Butter.** — ECKLES, C. M. and PALMER, L. S., in *University of Missouri College of Agriculture, Agricultural Experiment Station Research Bulletin No. 27*, pp. 1-44. Columbia, Missouri, December 1916.

For many years research work has been carried out at the Missouri Agricultural Experiment Station on the influence of various foodstuffs on the composition of milk and butter. Recently, a new series of experiments has been started on cottonseed products, in order to explain, if possible, the varied and inconsistent results obtained on this subject by other investigators. These experiments have shown that the roughage which forms the base of the ration is the real factor in the effect of cottonseed products on the composition and properties of butter. The amount of cottonseed products fed, particularly the quantity of cottonseed oil they contain, is also important.

Concerning the character of the roughage, the data obtained show convincingly that with certain roughages, such as timothy hay and corn stover, (dried maize stems with cobs removed), timothy hay alone, alfalfa hay alone or cottonseed hulls, very marked effects on the composition and properties of butter accompany the feeding of cottonseed products, in some cases even in moderate amount. On the other hand, certain roughages, particularly corn silage, so counteract the effects of cottonseed products that moderate quantities, e. g. 3 or 4 lbs. of meal, in some cases even as much as 6 lbs., may be fed daily without lowering the quality of the butter or changing appreciably the composition of the fat.

This paper includes: — 1) an historical part, with a chronological bibliography on the subject studied and 4 tables of numerical data; 2) an experimental part illustrated by 12 tables of analytical data.

The results obtained led to the following conclusions:

1) The feeding of cottonseed produces characteristic effects upon the physical and chemical constants of butter fat and upon the properties of butter. These are manifested, in general, by a decrease in the saponification value and Reichert-Meissl number, and an increase in the iodine absorption value and the melting point of the butter fat. The effects on the butter are to cause a firmer body, frequently a gummy consistency, a higher standing up quality or ability to withstand a higher temperature without losing its body, a flat, oily taste, and a better keeping quality.

2) The effects of feeding cottonseed products in the directions indicated are due largely if not entirely, to the amount of cottonseed oil which they contain.

3) The extent of these effects is largely modified by the character of the raw foodstuffs which form the base of the ration. The effects are

more marked when cottonseed products are fed with dry roughage, but less so if a fairly large amount of corn silage is given, as, in this case, the effects are sometimes neutralised. Further experiments are in progress to determine whether other roughages have similar properties.

4) Small amounts of cottonseed products may be fed to cows on fresh pasture with very beneficial effects upon the body and keeping qualities of the butter.

5) The effects of feeding cottonseed meal upon certain of the constants of the butter fat, particularly the Reichert-Meissl number and iodine value, may be somewhat modified by continuous feeding. The effects on the melting point of the fat and the other properties of the butter continue, however, as long as the cottonseed meal is fed.

6) The feeding of large quantities of cottonseed meal and whole cottonseed as still practised in many localities in the South must be considerably modified if the butter industry of that part of the country is to attain its proper place in the butter industry of the nation. The use of the whole seed as a feed for dairy cattle is to be strongly discouraged on account of its excessive oil content.

652 - **Pig Feeding Experiments on the Model Farm of Dikopshof, Germany.** — RICHARDSEN, A., in *Landwirtschaftliche Jahrbücher*, Vol. 49, Pt. 3-4. Berlin, 1916.

I. — THE FEEDING OF YOUNG PIGS.

Fifteen experiments were carried out to determine the nutritive value of "cerealis", a new food prepared by a factory at Andermach (Rhine) and recommended as a substitute for whole milk (fat) in breeding pigs. Experiments showed it to be a malt meal of the following composition (average of 6 samples).

Water	8.96 %	
Crude protein	12.56	(pure albumin 11.97 %)
Crude fat	2.68	
Nitrogen-free extract	68.28	(maltose 27.17 %; starch 27.59 %)
Crude fibre	3.79	
Ash	2.96	

The food differs from ordinary malt in that its starch contains more sugar.

The pigs of each group were of similar size and constitution. During the whole of the experiment (i. e. from the 31st. to the 120th day of their lives) each pig was given in each ration, which was fed as a warm wash, the total amount of food as shown in the table:

	Ration A	Ration B	Ration C	Ration D
Whole milk	20 litres	—	10 litres	10 litres
Skim milk	190 litres	40 litres	60 litres	100 litres
"Cerealis".	—	10.8 kg *	16.2 kg **	8 kg ***
Ground barley	51 kg.	51 kg.	76.5 kg.	64.5 kg.
Meat meal.	1.5 kg.	1.5 kg.	6.25 kg.	6.25 kg.

* 180 portions of 60 grams.

** 270 portions of 60 grams.

*** 160 portions of 50 grams.

As the price of "cereals" increased continuously, it was later replaced by two other foodstuffs called "R₁" and "R₂". The first is composed of: — Barley meal, 50 %; "Puttler" (Podler sugar) 45 %; Lime, 5 %; and the second of: — Podler sugar 90 %; Lime, 10 %.

The results of the experiments are summarized in the appended table.

Conclusions: — 1) Meat meal may well replace milk partially and physiologically in rearing pigs. In all the experiments the animals had good appetites and thrived well. It has not yet been determined whether or not this good effect is due to the maltose.

2) It is neither possible nor desirable to replace milk completely by "cereals".

3) The partial substitution of "cereals" for milk is specially marked when the growth of the pigs left a little to be desired and the new food was observed to increase their growth.

II. — PIG FATTENING.

Numerous very accurate experiments were made on the fattening value of various foods to determine how far one may be replaced by another. The animals received a basal ration to which was added the food to be tested; it was made up according to Kellner's values and given every 3 weeks in proportion to the live weight of the pigs. In addition each pig received per day: 6 gr. of salt and 6 gr. of lime. Each experiment included 2 or 3 periods. The pigs were usually weighed once a week.

Dried yeast compared with meat meal. — 98 day experiment with 6 pigs divided into 2 equal groups. — *Basal ration:* — Ground barley + rolled potato. To group A up to 3 kg. of meat meal per 1000 kg. of live weight were given per head, and to group B, up to 6 kg. of dried yeast. In order to ensure assimilation of the yeast the animals of group B also received 1 kg. of molasses.

Group A (meat meal) showed an increase in live weight of 633 gr. per day, and group B 518 gr. The quality of the meat was about the same in the two groups. It seems that dried yeast may easily replace meat in pig-fattening.

"Körnerblutfrutter" compared with meat meal. — The first food, prepared by FATTINGER & Co., Berlin, and put on the market in the form of grains is, according to HANSEN, a mixture of blood (10 %) and wheat meal (90 %) (1).

With 4 pigs, divided into 2 groups in each case, 4 experiments were made lasting 130, 105, 100 and 90 days respectively. The following *basal ration* was fed:

1st. experiment. — Rolled potatoes + barley.

2nd. experiment. — Potatoes + barley + fish meal.

3rd. experiment. — Crushed potatoes (2) + barley + fish meal.

4th. experiment. — Barley + rolled potatoes + fish meal.

Group I received up to 2 kg. of meat meal and group II up to 4 kg. of "Körnerblutfrutter" per 1000 kg. of live weight each day.

Taking the average of the 4 experiments, the daily increase in live weight was 631 gr. for group I (meat meal) and 615 gr. for group II ("Körnerblutfrutter"). 100 kg. of starch value had respectively 32.8 kg. and 32.5 kg. of live weight. The "Körnerblutfrutter" thus gave good, or even better, results than meat meal, but it is inadvisable to feed more than 7.5 per day per 1000 kg. of live weight of this food. It is best to mix it with fish meal in the kind of a part meal to 3 to 5 parts "Körnerblutfrutter". No special effect can be attributed to this last food.

Crushed potatoes compared with rolled potatoes. — Four experiments lasting 118, 77, 84 and 70 days respectively were made with 28 pigs. *Basal ration:* — Crushed barley + meat

(1) See also B. 1913, No 715.

(Ed.).

(2) Crushed potatoes (Preßkartoffel) are obtained by crushing the raw potatoes to remove part of the moisture, then drying the residue.

Results of 15 experiments.

Experiment		Number of animals	Rations	Daily increase per head	Cost price of 1 kg increase in live weight
No.	Group				
I	A	2	A	390 g	0.572 Mark
	B	4	B	277	0.578
II		3	A	383	0.573
III		6	C	448	0.533
IV		6	C	484	0.559
V		6	C	468	0.519
VI		6	C	442	0.544
VII	A	4	C	511	0.529
	B	4	C without "cereals"	456	0.434
VIII	A	3	C	471	0.574
	B	3	C without "cereals"	441	0.448
IX		10	D	372	0.604
X		7	D	370	0.608
XI		7	D	562	0.621
XII	A	3	D	420	0.500
	B	3	D with R_1 instead of "cereals"	420	0.423
XIII	A	3	D	386	0.561
	B	3	D with R_1 instead of "cereals"	394	0.473
XIV	A	3	D	333	0.648
	B	3	D with R_2 instead of "cereals"	330	0.565
XV	A	3	D	367	0.591
	B	3	D with R_2 instead of "cereals"	357	0.524

(1) 1 mark = 1/— at par.

meal in 3 experiments; Meat meal + fish meal in 1 experiment. Up to 20 kg. of rolled potato and 18 kg. of crushed potato per 1000 kg. of live weight were given each day.

The daily increase in live weight was: — 668 gr. with the rolled potatoes and 671 gr. with the crushed potatoes; 100 kg. of starch value of the foods gave respectively 34.6 kg. and 31.2 kg. of live weight. Apart from the formation of bone, the two foods gave the same result; one may, therefore, replace the other if the remainder of the ration is of normal composition. The flesh formed by these two foods was not inferior in quality to that formed by barley.

Sliced potatoes compared with Roumanian barley — 2 experiments, each of 63 days' duration, with 10 pigs. — Basal ration: — Group I: — "Maizena" (1) + fish meal; Group II: — "Maizena" + fish meal + blood meal 27 kg. of barley and 24 kg. of sliced potatoes were given daily per 1000 kg. of live weight.

The barley increased the live weight by 507 gr. per day; the sliced potatoes increased it by 613 gr.; 100 kg. of starch value of the food produced 31.4 kg. and 35.2 kg. of live weight respectively. There is not a great difference between the foodstuffs, nevertheless the potatoes gave rather more satisfactory results.

Sorghum compared with barley: Sorghum (*Andropogon Sorghum*) grain from German East Africa was compared with barley in 2 experiments lasting 118 and 97 days respectively.

Twelve pigs were used. — Basal ration: 1st experiment: — Sliced potatoes + meat meal

(1) "Maizena" is a food containing maize much used in Germany.

+ fish meal, 2nd experiment. — sliced potatoes + ground soya beans. Up to 20 kg. of barley and 20 kg. of sorghum per 1000 kg. of live weight were fed daily.

The average daily increase in live weight per day was 597 gr. with barley and 623 gr. with sorghum; 100 kg. of starch value of the foods gave 36.7 kg. and 37.7 kg. of live weight respectively. As sorghum gave rather better results it may replace barley, but it is inadvisable to feed it in larger quantities than half that of the starch value contained in the ration.

653 - **Temperature Experiments in Incubation.** - PHILIPS, A. C., in *Purdue Agricultural Experiment Station Bulletin* No. 195, Vol. XIX, December 1916.

This experiment was planned with the idea of finding out the influence of different temperatures in the incubator on brown and white eggs, with the hope of finding the upper and lower temperature limits, influence on temperature readings from placing thermometers at different heights in the machine, and several minor points.

Four incubators were employed and kept at the following temperatures:

100° F. — 101° F. — 102° F. — 103° F.; during each of the two following weeks the temperature was raised 1° F. In each incubator were placed 75 white eggs (white Leghorn) and 57 brown eggs (Plymouth Rock).

Four experiments were made, at the following dates:

Experiment No. 1	from April 18	to May 9,	1913
" No. 2 "	" 14	" "	5, 1915
" No. 3 "	March 2	" March 23,	1916
" No. 4 "	April 12	" May 3,	1916

The thermometers used, five in number, were standard incubator thermometers, generally known as hanging, standing, touching, and Inovo. The hanging thermometer was suspended from the top of the incubator, two inches above the centre of the egg tray. The standing thermometer was on a metal stand in the centre, towards the front of the machine, the bulb on a level with the top of the eggs but not touching them. The touching thermometers were two in number, one on brown and one on white eggs, near the standing thermometer. The bulbs of these were on a level with the top of the eggs and touching them. The Inovo is a long bulbed thermometer in a celluloid egg, supported by a stand, and is supposed to register the temperature of the germ in an egg. It was placed near the other thermometers. These were close together, so that any variation in temperature due to position in the machine, would be reduced to a minimum. All thermometers were tested and checked before each experiment.

The details of the observations are given in a set of 21 tables. The conclusions drawn are as follows:

1. A temperature of 101-102-103 degrees the first, second and third weeks respectively, using a standing thermometer on a level with the top of the eggs but not touching them, will prove very satisfactory in the artificial hatching of hens' eggs.

2. A temperature slightly above or below 101-102-103 degrees will not influence the hatch one way or another.

3. A temperature of 103-104-105 degrees is too high and will injure the hatch greatly.

4. A temperature of 102-103-104 degrees is a little high for successful incubation.

5. There seems to be little difference in number of chicks hatched between machines run at 100-101-102 degrees and machines run at 101-102-103 degrees. This means that at such low temperatures a variation of one degree or more will have little influence.

6. Operators of incubators should endeavour to hold down temperatures below common practice, rather than allow them to rise above it.

7. Brown and white eggs need the same temperature.

8. Brown eggs are no warmer or cooler than white eggs.

9. Brown eggs have a tendency to produce poorer fertility, more dead germs, more chicks dead in shell and fewer chicks than white eggs. No reason from the standpoint of incubation can be given for this peculiarity.

10. Under ordinary conditions, it is reasonable to expect white eggs to be 90 to 92 per cent. fertile and hatch 75 per cent. of the fertile eggs. Brown eggs will run 2 per cent. less in fertility and 12 per cent. to 15 per cent. less in hatchable fertile eggs.

11. Touching thermometers average slightly higher temperatures than standing thermometers. Such differences have no influence on the hatch.

12. As the chicks develop in the eggs, they give off heat tending to equalize the temperature in all parts of the machine. This is demonstrated by the hanging thermometer. This thermometer runs at a uniform temperature for the three weeks, but the temperature at the level with the eggs starts about 2.5 degrees lower and rises until it comes within one degree of the hanging thermometer temperature on the twenty-first day.

13. A temperature with a standing thermometer of 100.5 degrees the first week, 101.5 degrees the second and 102.5 degrees the third week compares well in temperature and hatching results with a hanging thermometer temperature of 103 degrees for three weeks.

14. There does not seem to be any hard and fast recommendation that can be given for the proper temperature of an Inovo thermometer.

654 - **Spore-Forming Bacteria of the Apiary.** - McCRAV, ARTHUR H. (Agricultural Assistant, Bureau of Entomology, United States Dept. of Agriculture) in *Journal of Agricultural Research*, Vol. VIII, No. 11, pp. 399-420, figs 6, Plates II. Washington, D. C., March 12, 1917.

Lambotte (1) in 1902, claimed to have produced "foul brood" of bees by feeding them cultures of *M. mesentericus vulgatus* and stated in explanation that *B. alvei* arises as a special variety of *M. mesentericus vulgatus* when the cultures are grown upon media prepared from the juices of bee larvae. This comparison of the two organisms disagreed so materially

(1) LAMBOTTE, U. 1902. Recherches sur le microbe de la " fausse ", maladie des abeilles. In *Ann. Inst. Pasteur*, t. 16, No. 9, pp. 693-704. Paris, 1902.

th the observations of the present writer that in 1911 he began a series feeding experiments with *B. mesentericus vulgatus*. At the outset, however, it was observed that of the organisms of the *B. vulgatus* group isolated from the specimens of bee comb and brood for examination it is not possible to identify all as one species. The first task was therefore identification of the various organisms of this group and a comparison of them with the other known spore-forming bacteria of the apiary: *B. alvei*, *B. larvae* and *B. orpheus*. The present paper gives the detailed observations of the writer on *B. vulgatus*, *B. mesentericus* and *B. orpheus* than an account of inoculation experiments carried out with the object of checking LAMBOTTE's claims. The results of these latter were negative throughout. The writer summarises his conclusions as follows:

There are at least 5 spore-forming bacteria of the apiary -- *B. vulgatus*, *B. mesentericus*, *B. orpheus*, *B. alvei* and *B. larvae*. Mistakes in the identification of the above-mentioned organisms might well be made, especially without knowledge of their occurrence. There seems no doubt that many of the earlier investigators of bee diseases confused the identity of the spore-forming bacteria of the apiary but from our present knowledge of these organisms, their identification should be a matter of less difficulty.

The author, from his study of *B. vulgatus*, *B. mesentericus* and *B. alvei*, believes that the biological differences of the 3 species are too great to warrant expecting the transformation of one to another in any short period of time.

Even if it is granted that LAMBOTTE fed pure cultures of *B. alvei* his results would not agree with those of present day investigators of bee diseases, since *B. alvei* has not been found to produce disease in bees upon repeated inoculations.

5 - **Partial Sterilisation of Mulberry Leaves in Feeding Silk Worms.** - SACCHI, ROSA, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. 4, Part 2, pp. 69-72, Modena, 1917.

The sterilisation of mulberry leaves as a prevention against "flacherie" has been attempted many times with varying results. The author has therefore, undertaken experiments to determine whether partial sterilisation either protects the worms from attacks of the disease or increases the vigour of vegetative growth.

The experiments were carried out at the Agricultural Institute of Arezzo in the spring of 1916, selected yellow Ascoli silk worms being used by preference. The silk worms were divided into 8 groups of 250 each, and subjected respectively to the following treatments:

- 1) Control group fed with ordinary leaves.
- 2) Fed with leaves washed in fresh water.
- 3) Fed with leaves washed in boiled water.
- 4) Fed with leaves washed in a lysoform solution prepared with fresh water.
- 5) Fed with leaves washed in a lysoform solution prepared with boiled water.
- 6) Fed with leaves washed in a "tachiol" (silver fluoride) solution prepared with fresh water.
- 7) Fed with leaves washed in a "tachiol" solution prepared with boiled water.

8) Control.

The solutions were made up in the following strengths :

"Tachiol" : during the 2nd. stage, 1 : 200 000 ; during the 3rd. stage, 1 : 150 000 ; during the 4th and 5th. stages, 1 : 100 000 ;

Lysoform : 2nd. stage, 2 %/100 ; 3rd. stage, 5 %/100 ; 4th. and 5th. stages, 5 %/100.

The results obtained led to the following conclusions :

1) If the silk worms are fed on leaves washed with water or a aqueous solution of lysoform or "tachiol", far fewer leaves are consumed than if they had not been subjected to the treatment described.

2) Although silk worms fed on moist leaves eat less they weigh more than those fed on dry leaves.

3) The treatments described did not prevent the occurrence of a few sporadic cases of "flacherie" and emaciation.

4) The silk cover of cocoons from silk worms fed on partially sterilised leaves is heavier than that from silk worms fed on ordinary leaves. The increase in weight also occurs when the silk worms are fed on leaves sufficiently well washed with fresh or boiled spring water.

5) The feeding of silk worms with washed leaves has a favourable influence on the quality of the silk, particularly on the length, tenacity and elasticity, as well as the weight of the reeled silk.

FARM ENGINEERING.

656 - The Encouragement of Mechanical Cultivation in Italy and France. — I. *Bollettino dei Ministri per l'Agricoltura, per l'Industria, il Commercio ed il Lavoro*, Year 16, Vol. 1, Parts 7 and 8, pp. 300-302. Rome, April 1 and 16, 1917. — II. *Feuille d'Informations, Ministère de l'Agriculture*, Year 22, No. 19, pp. 6-7. Paris, May 8, 1917.

ITALY : By decree of February 18, 1917, the Minister for Agriculture has issued the following order :

Subsidies to be granted to agricultural societies and syndicates for the purchase of tractors for immediate use on the land may amount to 30 % of the cost price of the machines, including ploughs and accessories.

Those organisations that buy at least 5 tractors for general use within the limits of a province, may receive a supplementary premium of 10 % of the cost price.

Subsidies to private agriculturists for the purchase of tractors for immediate use, may amount to not more than 20 % of the sale price, including ploughs and accessories.

Requests for subsidies should be directed to the provincial Commissions, and should include, besides technical details of the tractors and the price, the undertaking to buy the tractor within a limited time. The provincial Commissions will transmit the requests, together with the reasons for their approval, to the Ministry for Agriculture.

II. — FRANCE. — The Ministry for Agriculture has published the subsidies granted, in 1916, to the various syndicates, societies, communes and departments which are interested in mechanical cultivation, so as to enable them to purchase agricultural tractors and motors. The subsidies, ranging from 2 125 to 79 790 francs, make a total of 206 711 francs. The three national Schools of Agriculture have received, for the same purpose, subsidies amounting to 19 747 francs.

57 - The Donalies Patent Mechanism for Attaching One or More Implements to a Balance-Plough. — *Deutsche Landwirtschaftliche Presse*, Year 44, No. 27, p. 246, 5 fig. Berlin, April 4, 1917.

This new mechanism, invented by OTTO DONALIES of Cologne (German patent No. 296 491) is characterised by the fact that it enables one or more implements (harrow, roller, etc.) to be attached to a balance-plough, the implements turning simultaneously with the plough.

The DONALIES Mechanism for attaching one or more implements to a balance-plough.

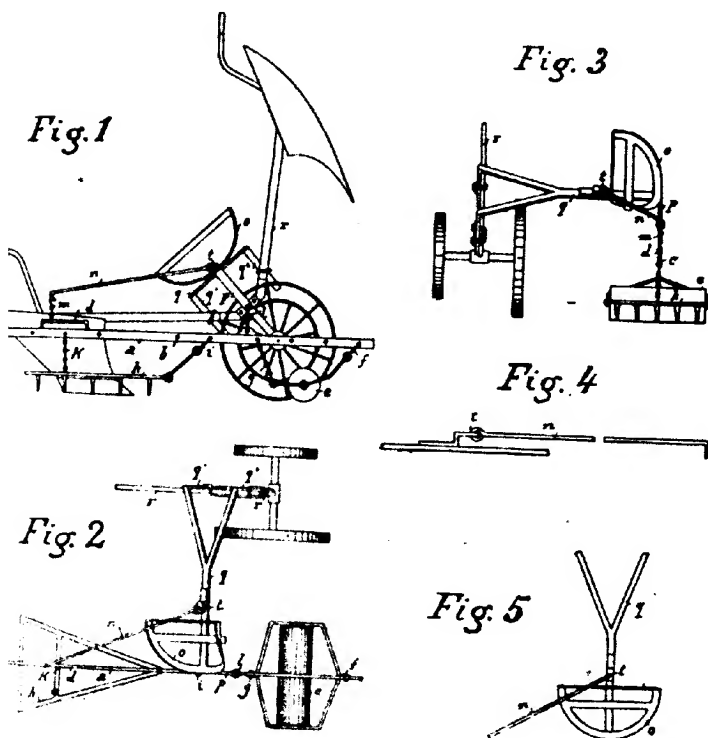


Fig. 1: Balance-plough with the mechanism in side-view.

Fig. 2: The same in plan.

Fig. 3: The same from the front.

Fig. 4: Jointed bar *a*, for moving the bar *a* so as to make a half-turn.

Fig. 5: The arched slide-bar *a* with the bar *a*, jointed at *t* with the support *q*; horizontal view.

The mechanism is shown with a balance-plough: in side-view fig. 1; in plan in fig. 2, in front-view in fig. 3; while fig. 4 shows the side view of the bar for turning the mechanism, and which is seen from above in fig. 5, with a portion of the turning mechanism.

A support *q* is fixed on the beam *r* by the feet *q*¹ and *q*², its front end being curved downwards and having an arched slide-bar *o* and a bar *n* mounted on it. The latter, jointed at its end *l* with the support, engages towards that end with the slidebar, along which it can run from one end to the other. To the front of the bar *n* hangs a chain *m*, and in front of the end *p* of the support *q* is attached a swivel hook *l* serving, like the chain, to support a bar *a* perforated with a number of holes *b* to support the implements, such as the harrow *h*, fixed by means of the chain *k* and the hook *i*, and the roller *e*, held by the chain *g* and the hook *f*.

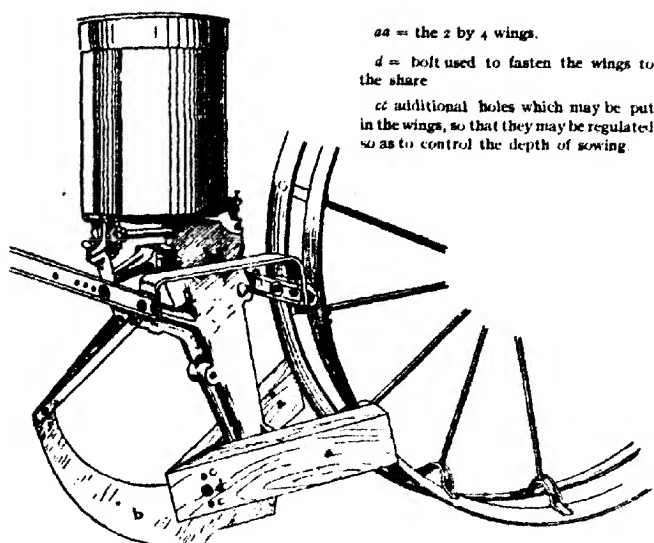
When the plough has arrived at the headland, the other mould-board is swung down, the support *q* (fixed to the beam *r*) being swung over with its slide bar at the same time; this forms a tipping action causing the bar *n* to slip from one end to the other and to carry with it the bar *a* which turns at an angle of 180° round the hook *l*, to right or left according to the direction in which the mould board is swung, the implements attached to it also turning. So that the latter can be guided straight after the automatic turning the bar *a* is provided with a stilt handle *c*.

658 - **A Lister Attachment for a Cotton Planter.** — HASTINGS, S. H., in *United States Department of Agriculture, Bureau of Plant Industry, Crop Physiology and Breeding Investigations*, 3 pp., 1 fig. Washington D. C., March 27, 1917.

In sowing cotton, the seed should be placed in a soil sufficiently moist and at such a depth that it can push its way through to the surface without difficulty. Where cotton is grown under irrigation, the soil is often allowed to become too dry before the seed is put in, and there is always danger that rain will cause a crust to form over the surface. Again, if planted too deep, the tender seed leaves cannot push their way up through a compacted soil, especially if the seed is planted deep.

The seed should not be covered with more than 1 1/2 to 2 inches of soil, but in dry regions it is rare that the surface soil will remain moist at that depth long enough to allow the seed to germinate.

To avoid these troubles and also to break the surface crust, the writer describes a simple device that can be adopted to any sower by the farmer himself. A hole is drilled through each shoe about half an inch from the top and about 7 inches from the rear of the shoe. Two pieces of 2 by 4 inch lumber, 17 inches long, with one side beveled so that when the shoes are placed one on either side of the shoe they will just clear the wheel completely the attachment. With this device there is no danger that the seed will be covered too deeply; besides the seed is planted at a very uniform depth, no matter how the condition of the surface soil may vary.



aa = the 2 by 4 wings.

d = bolt used to fasten the wings to the share

cc additional holes which may be put in the wings, so that they may be regulated so as to control the depth of sowing.

Planter attachment used to push away the dry surface soil

659 - **New Stump Burner for Logged-Off Lands.** — LE ROY W. ALLISON, in *Engineering Record*, Vol. 75, No. 13, pp. 495-496, 1 fig. New York, March 31, 1917.

The writer has previously described the ROSS stump burner (1). He now describes the HUBBARD stump burner, which operates more slowly through the use of natural draught, while the operating cost is reduced to a minimum.

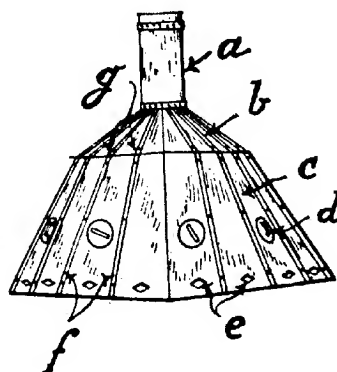
The burner consists of an adjustable steel hood of two principal sections to form a base and top, designed to be placed over the stump.

By means of draught tubes, placed around and near the base of the burner, the need for any blower or other artificial draught device is eliminated.

The lower section panels are made from steel sheets and are 11 in. wide at the top, 19 in. at the base and about 48 in. high. On one edge of each panel a $\frac{1}{2}$ in. lip is bent at an angle slightly in excess of 90° , while the other edge is made in the form of an inverted U, $\frac{1}{4}$ in. wide and $\frac{1}{2}$ in. deep. Bolt holes are punched near the bottom, middle, and top of its joint for the field connections. A 2-in. hole is provided in the centre of each of the lower panels near the base for the insertion of the draught tubes made of

(1) See *B* 1915, No. 947 and *B* 1916, No. 1067.

$\frac{1}{2}$ in. iron pipe. A damper, pivoted on a single rivet, covers the hole when the draft tube is not used. Every alternate panel has also an 8 in. hole for observation purposes.



- a* = Smokestack
- b* = Upper panels of No. 22 gauge steel.
- c* = Lower panels of No. 18 gauge steel.
- d* = Observation holes.
- e* = Draught tube holes with damper.
- f* = Lips and g-shaped edges of panels.
- g* = V-shape tie bolts for fastening upper to lower panels.

The upper section is composed of sheet steel panels, similar in shape and design to the lower panels. A $1\frac{1}{2}$ in. overlap is provided to allow for joining the upper and lower sections by means of V-shaped tie bolts.

The smokestack, of sheet metal, is adjustable, and is supported by a metal band at the base and top of the cylinder. The size of the smokestack varies according to the number of panels used to make up the burner. A 12 in. stack has been found in practice the best size to use with a sixteen panel hood.

In erection the lower panels are bolted together in groups of 2 or 3, to facilitate handling and moving. The different groups are then placed round the stump and the remaining connections made with heavy cotter pins. The roof section is bolted together and the stack is attached before being fastened to the bottom panels. Before operating, dirt, etc., is cleared away sufficiently to allow kindling of a good fire. The fire is started through the observation openings and the draught pipes are inserted so as to give the best draught. The draught increases as the temperature rises under the hood, being augmented by feeding logs to the fire as needed after kindling.

This burner will consume stumps of from 3 to 5 ft. in diameter in 24 hours, while 6 to 7 ft. stumps require 30 or 40 hours.

660—The "Jahn" Curved Knife for Root-Pulping Machines.—*Deutsche Landwirtschaftliche Presse*, Year 41, No. 28, pp. 254-255, 3 figs. Berlin, April 7, 1917.

The flat, toothed knives ordinarily used in machines for cutting manure and other forage roots into slices have to be placed obliquely to the cutting plane so that they tear rather than cut, thus wasting much energy as well as valuable juice from the roots.

These disadvantages may be avoided by using knives whose rounded teeth ("getollte Messer") are in the cutting plane. Machines having such knives work well and easily and cause less loss of juice: but they have

Knives for root pulping machines.

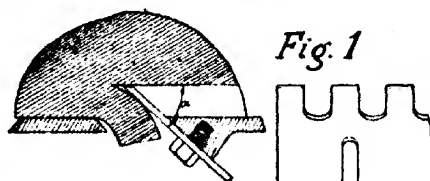


Fig. 1

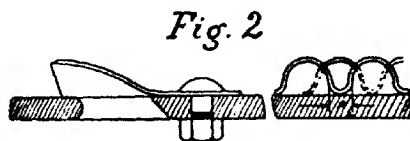


Fig. 2

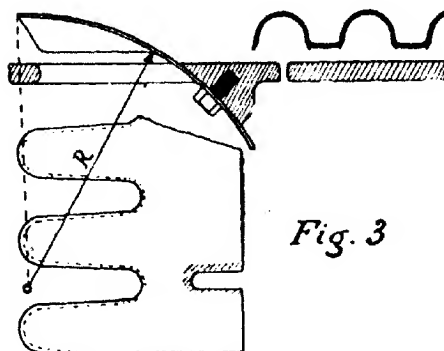


Fig. 3

Fig. 1: Ordinary flat-toothed knife.

Fig. 2: Round-toothed knife.

Fig. 3: The new curved, toothed knife of GEORGE JAHN

always the disadvantage that once in place they cannot be regulated, and as they wear, their work gradually deteriorates.

The knife invented by GEORGE JAHN of Liegnitz (German patent No.

297 219), combines the advantages of the easily-regulated, flat-toothed knife with those of the round-toothed knife (easier to work and less loss of valuable juice), without having the disadvantages inherent to each of the types. Accordingly, the blade is curved in an arc of a circle in the direction of cutting, as is the back which connects it with the concave projection of the knife holder with a similar curve. This curve is such that the cut is perpendicular to its radius so that the cutting angle = 0° . On the other hand, as the knife can be moved on the concave bed, it can be adjusted as it wears, by always turning it round the centre of the curvature (that is round the interior extremity of the radius of the curve), so that the cutting angle is not changed by wear of the edge (as shown in fig. 3).

661 - **The Schilde "Universal Drier"** — PAROW, in *Zeitschrift für Spiritusindustrie*, Vol. 40, No. 2, p. 13, 9 fig. Berlin, January 11, 1917.

The BENNO SCHILDE machine shops at Hersfeld (Germany) manufacture a drier adapted specially to fruit and vegetables, but also suited for drying other moisture-containing products and for cereals, whence its name of "universal drier" ("Universaltrockner"). The advantages of the drier are as follows: small bulk, easy to set up, requires little attention (1 man and a couple of women suffice to run it), relatively high yield at its equal to the demands of high-class trade. The city of Berlin possesses 2 machines of this type among its vegetable drying plant and will shortly instal a third.

At the request of the firm of SCHILDE, the writer has submitted the drier to careful tests; although not yet quite completed they already show that the apparatus is a valuable acquisition to the trade in dried agricultural produce.

The SCHILDE "Universaltrockner" (of which Plate I shows the external appearance and Plate II the internal arrangement and working) is a tray drier (Hordentrockner), composed of an iron cage flanked by an automatic hoist and containing a chamber in which the air is heated by means of heating set *g* (Plate II, fig. 1) adjoining another drying chamber ("Trockenschacht") which contains 10 racks ("Horden") 6 sq. metres in size, forming 2 compartments of 5 racks separated by a second heating set *h*: ventilator *B*, placed at the top of the cage, draws up the air of the room: which the drier is placed, and then passes it through the aperture *A* into the heating chamber where after being warmed to a temperature of 60 to 70° C. it passes over the trays from top to bottom, is heated anew over another heating set *h* ("Nachheizbatterie"), rises at a temperature of 85 to 95° C. and passes through the 5 loaded trays of the upper compartment, eventually reaching, cooled to about 32° C. and saturated with water vapor, the discharge pipe *c*.

The trays, being moveable, allow the matter to be dried to be moved downwards from top to bottom while the hot air is passing through in the opposite direction: from below upwards. To do this the fresh produce is lifted by means of the automatic hoist at the side, right to the top of the drying chamber, whence it descends, gradually losing moisture, first to the bottom

the upper compartment and then, passing the second battery *b* in the upper compartment continues in the same direction meanwhile losing its remaining moisture, and eventually reaches the bottom where the finished product is discharged.

The various steps of the above process, illustrated by the 7 figures of

SCHILDE "Universal Drier".

PLATE I — Exterior view.

Fig. 1

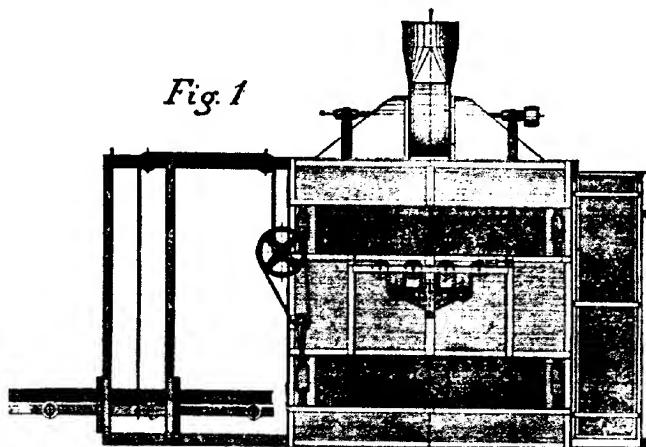


Fig. 2

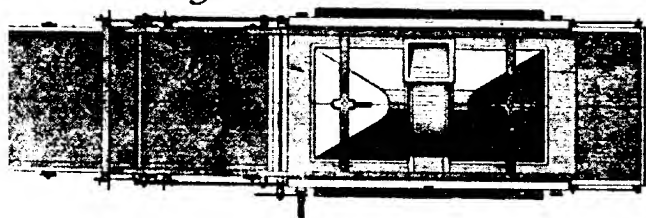


Fig. 1: Side view.

Fig. 2: From above.

Fig. 11, are as follows: 120 to 130 kg. of the fresh produce are spread evenly on the hoist (fig. 2), a lever is pulled and the hoist rises automatically (fig. 3) to the top of the drying chamber where the produce is slid off the rollers and introduced through the open door *d* (figs. 1 and 4). This

SCHILDE "Universal Drier"
 PLATE II. — Internal arrangement and working.

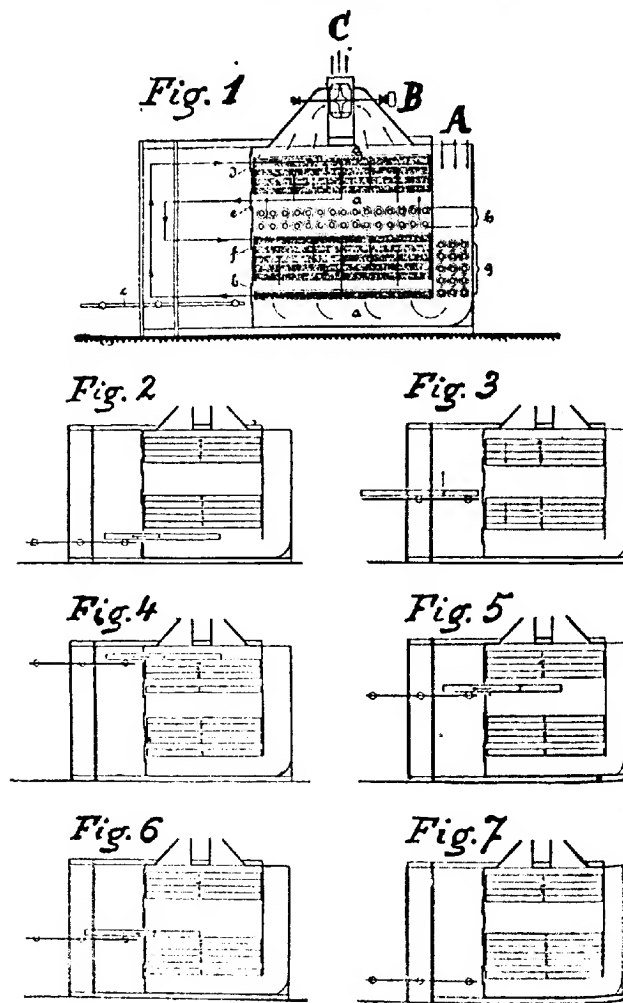


Fig. 1: Longitudinal section.

→ Direction of air currents

→ Path travelled by hoist.

Figs. 2-7: Schematic longitudinal section showing stages in working of hoist.

door is then closed and the ventilator C set in motion which draws up the hot, dry air through the whole of the drying chamber. Subsequently, another lever allows the empty hoist to descend, pick up another tray at the bottom full of fresh produce, and convey it to the top. This operation is repeated until the upper compartment (which is warmer) contains 5 trays full of material to be dried.

When this is completed, the hoist is no longer sent down to the bottom but only as far as the level of the door *e*, corresponding to the lowest tray of the top compartment (figs. 1 and 5). This tray, which was introduced first and contains matter which has already undergone the first drying, is then withdrawn through the door *e* onto the hoist which descends to the level of the door *f* at the top of the lower compartment (fig. 1). The produce on the tray is then turned and the latter allowed to enter the lower compartment, beneath the second battery (figs. 1 and 6) to complete the drying. This done, another pull at the lever allows the empty hoist to descend, pick up a full tray and rise to the top where it replaces, in the upper compartment, the tray just extracted. The hoist then drops to the end of the door *e*, picks up the lowest tray of the upper lot and descends to the level of the door through which it enters the lower compartment. The hoist then drops to the bottom, again picks up a full tray and rises to the top of the upper compartment.

These operations are repeated in the same order until the drying chamber contains all 10 trays full of produce in course of drying.

When this lot of operations is accomplished, the hoist, when it has reached the bottom, no longer picks up a fresh tray full of fresh produce (which could be the 11th), but takes the lowest tray of the bottom compartment (viz.: the first introduced into the apparatus, see fig. 7). The dry product is then removed from the tray, spread with fresh stuff and the cycle of operations begins anew.

As the apparatus receives a fresh tray of produce every 20 minutes and all 10 trays have been used, the complete drying process occupies 200 minutes, i. e. 3 hours and 20 minutes. The work capacity of the plant may be estimated as follows: supposing it to be fed fresh slices of swede at the rate of 21 kg. per sq. metre of tray it could dry 9000 kg. of these slices in 124 hours, equivalent to 12 000 kg. of swedes.

During the tests, slices of peeled roots were dried both raw and having undergone previous soaking. In both cases a dry product was obtained of good appearance and flavour and containing about 13.5 % of moisture. The product obtained from roots soaked in hot water was distinguished by particularly good aroma.

62 - **The Hyatt Dynamometer.** — *The Canadian Thresherman and Farmer*, Vol. XXII, No. 2, p. 20, 1 fig. Winnipeg, February 1917.

This tractor dynamometer, built by the HYATT ROLLER BEARING COMPANY, Chicago, Illinois, has been used in a great many tractor trials to assist in the development of better machines. It consists chiefly of a hydrostatic pressure unit coupled between the tractor and the plough and a record;

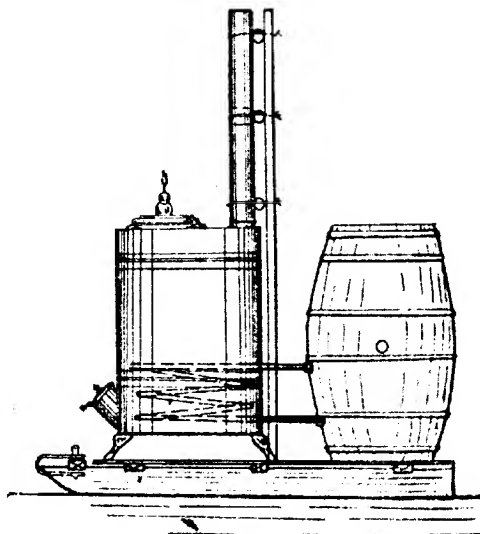
ing gauge which automatically records the draw-bar pull by means of a needle moving over a chart.



HYATT Dynamometer.

663 - **Portable Water Heater.** — COVELL, EARD D. in *Engineering Record*. Vol. No. 13, pp. 520, fig. New York, March 31, 1917.

A portable water heater used very successfully by the writer in bull



Portable water heater.

g small concrete structures for irrigation canals is shown in the sketch. s the structures averaged between 6 and 10 cu. yds. of concrete each, it as necessary to have some means of heating the water that could be moved sily and quickly.

The heater built consists of a common sheet-iron heating stove inside- hich was fitted a coil of 1 inch, black iron pipe with three turns, the ends hich were fastened into the sides of the water barrel with lock nuts. e stove and barrel were wired securely to a stone boat. When the con- ete mixer was moved about, the heater was easily pulled along behind.

4 - Review of Patents.

Tillage Machines and Implements

Austria	73 469. Tractor plough with the plough body frame fixed, and adjustable in height by means of a hand screw.
France	482 944. Motor-tractor for vineyard cultivation. 482 980. Animal-drawn motor cultivator.
United Kingdom	104 906. Cultivating implements.
United States	1 216 836. — 1 221 783 — 1 222 364 — 1 222 884 — 1 222 898 Ploughs. 1 216 568. — 1 216 810 — 1 223 558. Cultivators. 1 220 181. Cultivator shovel or tooth. 1 220 383. Motor-driven tractor-cultivator. 1 220 449. Self-adjusting coulter-wheel for ploughs. 1 220 475. Harrow. 1 220 485. Wheel attachment for harrows. 1 220 982. Power-interrupting device for tractors. 1 221 148. Riding attachment for harrows. 1 221 158. Riding harrow. 1 221 230. Disc harrow. 1 221 503. — 1 221 915. Coulters. 1 221 565. Cultivating implement. 1 221 764. Sidehill gang plough. 1 221 902. Sulky plough. 1 222 117. — 1 224 025. Tilling machines. 1 222 299. Traction plough. 1 222 387. Motor-plough. 1 222 388. Stalk chopper for maize. 1 222 517. Lifting mechanism for ploughs. 1 222 647. Power-driven agricultural implement for ploughing. 1 222 918. Drag-harrow. 1 223 029. Rotary plough. 1 223 145. Double disc harrow. 1 223 808. Slat mouldboard. 1 224 101. Brake for ploughs.

Manures and Manure Distributors.

Austria	73 594. Liquid-manure distributor.
United Kingdom	104 174. Process for converting phosphate rocks and potash-bearing rocks into a manure containing citrate soluble phosphates and potassium sulphate.

- United States 1 216 902. Manure Loader.
 1 221 742 — 1 222 208. Fertilizer-distributor.
 1 221 863. Wide-spreading device for fertilizer distributors.

Drills and Sowing Machines.

- United States 1 216 281. Clutch mechanism for corn planters.
 1 216 377. Combined planter and cultivator.
 1 216 419 — 1 223 967. Combined planter and fertilizer distributor.
 1 216 449 — 1 222 386. Planters.
 1 216 788 — 1 217 011 — 1 223 838. Corn planters.
 1 221 192. Lister.
 1 222 113. Peanut planter.
 1 222 228. Cotton-seed planter.
 1 222 884. Fender for seeders and planters.
 1 223 142. Grain-drill.

Various Cultural Operations.

- United States 1 221 974. Separator for soil.
 1 222 122. Hand cultivator on wheels.
 1 222 701. Weed-cutter.
 1 223 868. Cotton-chopper.

Control of Diseases and Pests of Plants.

- Austria 73 467. Spraying and dusting machine for farm use.
 United Kingdom 104 222. Device for destroying insects.
 United States 1 216 746. Spraying apparatus.
 1 216 917. Boll-weevil destroyer.
 1 222 706. Insect-destroyer.

Reapers, Mowers and Harvesting Machines.

- Austria 73 461. Hitch for a binder or other agricultural machine and a tractor.
 73 596. Reel for attachment to a reaper.
 United Kingdom 102 039. Device for collecting rubber latex, etc., from trees.
 104 301. Mowing-machine.
 104 929. Harvester for maize, etc.
 United States 1 216 368. Grain-binder.
 1 216 585. Header.
 1 220 489. Lawn-mower.
 1 220 931. Cotton-harvester.
 1 221 119. Seed-harvester.
 1 221 316 — 1 221 364. Corn harvester and husker.
 1 221 541. Hay-rake.
 1 221 743 — 1 221 820. Shocking-accessory for harvesting machines.
 1 221 980. Dividing board for mowers.
 1 222 716 — 1 222 730. Combined harvester and thresher.
 1 222 717 — 1 222 718 — 1 222 796 — 1 222 797 — 1 222 798 — 1 222 771.
 Shocking machines.
 1 222 815. Combined rake and tedder.
 1 222 878. Fruit-gatherer.
 1 223 999 — 1 224 000 — 1 224 003 — 1 224 004. Harvesters.
 1 224 114. Combined harvester.

Machines for Lifting Root Crops.

- Austria 73 462. Potato getting machine with mobile forks.
 Switzerland 75 127. Potato-getting machine.
 United States 1 216 715 — 1 222 098. Beet harvesters.
 1 220 977 — 1 221 775 — 1 222 099. Beet toppers.
 1 221 729. Potato-harvester.

Threshing and Winnowing Machines.

- Switzerland 74 918. Seed-sifting machine.
 United Kingdom 104 216. Threshing-machine.
 United States 1 220 477. Pea-vine threshing and hulling machine.
 1 220 657. Grain separator.
 1 220 901. Self-feeder for threshing-machines.
 1 222 111. Seed grader.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

- Switzerland 74 912. Process for preserving green forage in silos.
 75 129. Forage press.
 United Kingdom 104 327. Device for drying hay, etc.
 104 418. Baling-press.
 104 422. Harness.
 United States 1 216 350. Travelling stock-gatherer.
 1 216 407. Feeding-attachment for baling presses.
 1 220 339. Hay-loader.
 1 221 220 — 1 221 573 — 1 221 625. Hay-presses.
 1 221 375 — 1 221 491. Hay-stackers.

Forestry.

- United Kingdom 105 136. Firewood splitting machine.

Steering and Traction of Agricultural Machinery

- United Kingdom 101 117. Reversible racket clutches for driving the land wheels of agricultural implements.
 104 586. Tractors.
 United States 1 216 651. Motor-vehicle.
 1 217 022 — 1 221 022. Combination-eveener.
 1 220 388 — 1 221 320 — 1 221 730 — 1 221 975 — 1 222 260 — 1 222 335 —
 1 222 557 — 1 223 505. Tractors.
 1 222 295. Tractor chain-tread.
 1 222 580. Adjustable clevis for agricultural implements.

Feeding and Housing of Livestock.

- Austria 73 522. Feed for hay-chopper.
 Switzerland 74 914. Movable troughs for pigs, etc.
 75 130. Process and apparatus for cleaning animals.
 75 131. Device for closing mangers.
 75 133. Reinforced concrete trough for liquid food.
 75 134. Trough for wet and dry pig-food.
 United Kingdom 104 311. Restraint for weaning calves, etc.
 105 042 — 105 097. Machines for making horseshoes.
 United States 1 221 484. Hog-rolling device.

Dairying.

Switzerland	75 152.	Hand-driven butter maker.
United Kingdom	104 995.	Stoppers for milk bottles.
	105 093.	Butter, cheese, and the like cutter.
United States	1 221 483 — 1 221 634 — 1 222 826.	Milking machines.

Farm Buildings.

United Kingdom	104 489.	Ventilators for windows, doors, and walls.
United States	1 221 519.	Pump for deep well.
	1 222 849.	Silo.

Various.

United Kingdom	104 182.	Device for wrapping-up potted plants.
	105 043.	Stirrup-strap suspenders.

RURAL ECONOMICS.

665 - **Financial Statement of the Delaware Experiment Station Peach Orchard** (11).
 McCUE, C. A., in *Delaware College Agricultural Experiment Station, Bulletin No. 11*,
 pp. 1-21. Newark, Delaware, June 1916.

The Delaware Agricultural Experiment Station has published a financial statement of its orchard of 1033 peach trees. The orchard, planted in 1908, covers an area of about 9 $\frac{1}{2}$ acres. The first crop was produced in 1912, and all the trees were bearing fully in 1915.

The report gives details of the cost of labour and material, and the expenses incurred per tree per acre, as well as the yield of the orchard per tree and per acre. As the orchard is used for experimental purposes, the expenses are necessarily a little higher than they would be were the orchard run on strictly commercial lines. Moreover, the estimate is based on fixed valuation of the labour of men and horses per hour for the 8 years; one of the great difficulties with which a commercial grower is faced, the distribution of work during the year, is thus avoided.

The details concerning the planting of the orchard, the methods used and expenses incurred, the crop and financial results may be summarised as follows:

The orchard was planted in 1908 in fresh, deep, arable soil. There are 9 $\frac{1}{2}$ acres of peach trees planted 20 feet \times 20 feet. The varieties included 658 Elberta, 320 Belle of Georgia, and 55 Champion trees, 1033 trees in all. Six hundred of the Elberta trees were planted in 24 equal plots and used for 20 fertiliser experiments. Three hundred of the Belle of Georgia divided into 12 equal lots, were used for 9 cover crop experiments. The remaining trees were used for other experimental work, such as spraying etc. The year the orchard was laid out it was interplanted with maize in the following years it was given clean culture and then seeded down to

(1) See also in *B.*, 1916, No. 440: Cost of running a peach orchard in North Carolina, U. S. D.
 (Ed.)

TABLE 1. — *Expenses of the Peach Orchard of the Delaware Agricultural Station for the 3 years 1908-1915 inclusive, and Average Expenses per Acre, per Tree and per Basket (1½ bushels).*

	1908	1909	1910	1911	1912	1913	1914	1915	Total	Cost per acre	Cost per tree	Cost per basket
dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars	dollars
1) Pruning and hauling brush	1.50	4.50	10.00	18.00	59.76	122.00	104.56	153.48	473.70	49.58	6.198	0.8273 0.029067
2) Pruning labor	—	5.00	10.00	28.64	81.51	75.15	169.25	137.23	599.37	53.16	6.650	0.8616 0.031708
3) Spraying materials	—	0.80	16.45	19.80	47.40	47.84	70.33	76.72	279.34	29.22	3.650	0.0338 0.017211
4) Cultivation and sowing cover crops	37.00	54.13	57.74	76.20	41.71	63.11	41.36	51.38	418.63	45.08	5.385	0.0498 0.025064
5) Mixing and applying fertilizers	12.00	8.00	13.80	8.00	8.00	8.00	8.00	8.00	75.80	7.93	0.981	0.0091 0.004277
6) Fertilizers	55.45	62.00	66.36	38.50	52.50	49.31	46.74	53.92	454.91	47.58	5.845	0.0460 0.0250 0.02371
7) Cover crop seed	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	108.00	12.00	1.491	0.0150 0.007371
8) Weeding	—	3.00	10.00	18.00	18.00	12.00	12.00	22.00	102.00	9.10	1.131	0.0093 0.004332
9) Harvesting	—	—	—	—	18.99	21.11	25.00	22.00	127.00	23.96	3.000	0.0277 0.014088
10) Hauling	—	—	—	—	8.15	59.30	237.04	384.76	770.36	80.38	10.072	0.0912 0.048045
11) Time on sale of tools	—	—	—	—	1.00	94.20	56.00	416.79	1,066.99	106.31	13.668	0.1267 0.061592
12) Repairing trees	—	—	—	—	—	4.76	10.00	1.69	26.30	2.86	0.310	0.0027 0.001695
13) Freight bills (at 4 cents each)	10.00	—	—	—	—	—	—	9.00	37.75	3.95	0.490	0.0060 0.002335
14) Cost of trees (at 4 cents each)	41.11	—	—	—	—	—	—	58.70	250.40	26.40	3.290	0.0376 0.019725
15) Preparing and hauling	—	—	—	—	—	—	—	18.40	81.35	8.53	1.060	0.0127 0.006377
16) Hauling about trees	—	—	—	—	—	—	—	—	32.68	3.33	0.410	0.0054 0.003385
17) Preparation of land for planting	3.15	14.49	—	—	—	—	—	—	17.55	1.84	0.230	0.0028 0.001094
18) Fencing	40.00	—	—	—	—	—	—	—	40.00	4.16	0.520	0.0048 0.002494
19) Planting	7.85	—	—	—	—	—	—	—	7.85	0.82	0.100	0.0090 0.004384
20) Cost of seed and planting corn crop	17.30	—	—	—	—	—	—	—	17.30	1.83	0.230	0.0028 0.001094
21) Thinning and hoeing corn crop	6.00	—	—	—	—	—	—	—	6.00	—	—	—
22) Harvesting	—	—	—	—	—	—	—	—	11.00	—	—	—
23) Thinning and application	—	—	—	—	—	—	—	—	10.00	—	—	—
24) Time and application	—	—	—	—	—	—	—	—	8.75	0.91	0.114	0.0010 0.000345
Totals	261.80	189.43	221.60	299.29	616.00	379.32	796.60	1,454.75	4,899.91	546.50	63.248	0.8084 0.392900

cover crops. Spraying and summer and winter pruning are carried out regularly every year.

Table I gives the yearly cost of production for each separate process as well as the expenses incurred during the 8 years per acre, per acre per year per tree, per tree per year, per $\frac{1}{2}$ bushel. The invested capital and the interest on the capital are included in the financial statement. The figures in Table I represent the cash value of the work done by the labourers and animals, which has been estimated as follows: man labour per hour, 15 cents; labour of man and team per hour, 40 cents; labour of man and one horse per hour 27 $\frac{1}{2}$ cents.

Table II gives the quantity of peaches produced by the orchard during the 4 years 1912-1915, their price and their value. It should be noted that the 1913 harvest was partly destroyed by a hard spring frost.

TABLE II. — *Record of Peach Harvests from 1912-15 inclusive.*

Year	Numbers of baskets ($\frac{1}{2}$ bushel)	Amount received dollars	Average price per basket, cents
1912	1 669	1 179.15	59.85
1913	1 132	1 083.00	76.66
1914	6 094 $\frac{1}{2}$	2 794.60	41.65
1915	7 199	2 542.54	28.13
Total and averages . . .	16 034 $\frac{1}{2}$	7 599.29	51.31

The yield per tree and per acre for both picked and dropped fruit for the two varieties, Elberta and Belle of Georgia is given in Table III.

Financial Statement: The original cost of the land was approximately \$100 per acre, bringing the initial investment on 9.56 acres up to \$956.00. Compound interest at 5% up to the end of the 5th year, the first in which a yield was obtained, is \$264.12. The total expenditure to the end of the 5th year is \$1522.08; if the interest on the land investment be added to this, there is, at the end of the 5th year, a total expenditure of \$1786.20, as against a return of \$1179.15. The 6th year, therefore, opens with a debt of \$607.05, which, at the end of the year, together with the year's expenses, interest and debts, equals a total of \$1292.65, as opposed to an income of \$1083.00. The debt at the beginning of the 7th year is \$209.65. The expenditure at the end of that year is \$1554.53 and the income \$2784.60, there is, therefore, a profit of \$1240.07. The total capital invested at the end of the 8th year is \$1502.09, the income \$2542.54, showing a profit of \$1040.45. The average yearly profit for the 8 years is \$285.06 or \$29.81 per acre which is 29.8% on the original investment. The profit per basket is 12.923 cents.

TABLE III. — Annual yield in $\frac{1}{2}$ bushel baskets of the varieties "Elberta" and "Belle of Georgia".

Variety	Year	Yield per Tree			Yield per Acre		
		Picked fruit	Drops and Culls	Total Baskets	Picked fruit	Drops and Culls	Total Baskets
Elberta	1912 . .	1.30	0.08	1.38	139.86	8.64	148.50
	1913 . .	1.65	0.10	1.75	178.20	10.80	189.00
	1914 . .	5.21	0.94	6.15	562.68	101.52	664.20
	1915 . .	5.02	1.61	7.23	603.96	173.88	777.84
	Total	13.18	2.73	16.51	1484.70	295.04	1719.54
4-Year average		3.43	0.68	4.13	371.18	73.76	444.94
Belle of Georgia	1912 . .	2.19	0.09	2.28	236.52	9.72	246.24
	1913 . .	0.01	—	0.01	1.08	—	1.08
	1914 . .	5.88	0.75	6.63	635.40	81.00	716.04
	1915 . .	5.88	1.23	7.11	635.04	132.84	767.88
	Total	13.96	2.07	16.03	1507.64	223.56	1731.24
4-Year average		3.49	0.52	4.01	376.92	55.89	432.81

AGRICULTURAL INDUSTRIES.

65 — Experiments on the Deacidification of Wine, in Italy. — Mazzero, C., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I, Pts. 3-4-5, pp. 225-244. Modena, 1917.

The author studied the chemical composition of a 1914 white Barbera wine. The acidity of this wine was so high (16.3%) that it was almost unrinkable. The owner had kept a certain quantity at a temperature of 0° C. to see whether, a deposit of tartar would form. Another lot was kept at a temperature of 12°-20° C. to see whether heat would cause malo-lactic fermentation. As the composition of the wine did not change under these conditions the acid was neutralized by the addition of 660 gr. of potassium bicarbonate per hectolitre. The results of the analysis are given in 13 tables. An examination of these tables shows that, even wine in which the acid had been most vigorously neutralized and which also underwent strong malo-lactic fermentation, still contained free tartaric acid.

The practical conclusions obtained may be summarised as follows: The 3 wines studied were of a very peculiar composition. The two first are remarkable for their high percentage of organic acids, mostly in the free state, and for their very strong acid energy, which exceeded that hitherto found in wines of the same origin.

The acid energy of these wines may be compared to that of an $N/100$ hydrochloric acid solution, although the values obtained for ordinary Italian wines range between those represented by $N/1000$ and $N/2000$ hydrochloric acid solutions.

The third wine was remarkable for its large quantity of combined organic acids and its very weak acid energy, barely equal to that of an $N/1000$ hydrochloric acid solution. The analytical results of the third sample show the disadvantages of using potassic salts for neutralizing acidity, and emphasize the necessity of calculating the quantity of acid-neutralizing salts, not by the total acidity of the wine, but by the total amount of tartaric acid it contains. Not more than $1/2$ of this acid should be neutralized, and, preferably, only the half, so that the acidity of the wine shall not be lowered too much, because neutralization of acid is usually followed by a more or less vigorous malo-lactic fermentation.

In the wine examined the process should have been carried out as follows: total tartaric acid content 5.7 gr. per litre; tartaric acid to be saturated 3 gr. per litre or 300 gr. per hectolitre. Since 0.66 gr. of calcium carbonate neutralizes 1 gr. of tartaric acid, 200 gr. of calcium carbonate per hectolitre will be required. By this method the acidity and acid energy of the wine would not have been so greatly reduced as was actually the case, but the reduction would still have been sufficient to allow malo-lactic fermentation, and the wine would have been greatly improved. If, instead of calcium carbonate, potassium bicarbonate were used, about 200 gr. per hectolitre would have sufficed instead of the 660 actually used.

Not only in neutralizing acids, but also in estimating the acidity of wine, the acids it contains must be known and attention given to the possibility of malic acid fermentation. It should be noted in this connection that the estimation of lactic acid is very important and should form part of the routine of all laboratories for the examination and analysis of wines.

667 - **The Reduction in Volume of Wine due to Fermentation.** — DE ASINIS, G., in *Le Sperimentazioni agrarie italiane*, Vol. I, Pt. 2, pp. 87-96, 2 figs. Modena, 1917.

The work described was carried out at the Chemical Laboratory of the "R. Cantina Sperimentale" (Experiment Cellar) of Arezzo, Italy.

There are many data on the decrease in *weight* of must during vinification as a result of alcoholic fermentation, especially when it is transported over long distances. In cutting wines this decrease in weight is known to vary between a minimum of 0 and a maximum of 13 %, according to whether the fermentation develops partly or wholly, or whether the must does not ferment.

As, on the contrary, there are no data on the decrease in volume, the author has determined this experimentally. He has established that the volume occupied by glucose in any must is equal to the weight of the sugar Z divided by 1.613 (density of the glucose).

The action of the fermentation gives, on one hand, a decrease in volume due to lost sugar, on the other hand, an increase in volume due to the alcohol, and secondary volatile products formed at the expense of the

fermented sugar. The volume of alcohol produced by the fermentation exceeds the initial volume of sugar. There will, therefore, be an increase in volume during the transformation of the must into wine, so long as this is not prevented by a contraction in volume produced by the alcohol in the presence of water. It is well known that, by mixing 53.9 litres of absolute alcohol with 49.8 litres of water, a volume equal to 100 litres is obtained, that is to say a contraction of 3.70 % takes place. Theoretically then, there is a contraction of $3.70 : 53.9 = 0.686$ per degree of alcohol produced by the fermentation. The author has proved that, in practice, this contraction varies from 0.68 to 0.76 per degree of alcohol when mixed with water, dealcoholised wine or sweet must. The theoretical and practical coefficients, therefore, coincide fairly well.

It is, thus, possible to calculate the decrease from the fermentation per cent. of volume of the must into wine by dividing the percentage of fermented sugar by the density of the glucose (1.613), and subtracting from the quotient the volume of the percentage of alcohol multiplied by its contraction coefficient 0.686. To this decrease must be added that corresponding to the volume of the lees of the wine, a volume which varies in different wines, and which, in the wines examined by the author (white, Trezzo), varied from 0.41 litres to 0.73 litres, corresponding to from 0.68 to 1.12 kg. of dry weight per hectolitre of wine.

To sum up, for these two factors, the reduction in volume of the must into wine varied from 0.7 to 1.2 %; 1 % may be taken as a general average. From this calculation are excluded all other causes of reduction such as variations in temperature and pressure, evaporation, loss due to the processes, etc.

58 - Contribution to the Study of Apiculated yeasts. — KAYSER, E., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 164, No. 16, pp. 730-731. Paris, May 7, 1917

The great need of alcohol of the French ministry of munitions, and the abundant apple crop of 1915, led to the use of apples either alone, or mixed with commercial beets, in distilling.

Amongst other difficulties, a certain antagonism was found between the east of grain and that of apples. There was also a large proportion of volatile acids and ethers. The author attempted to explain this by subjecting the must of mangolds and apples to fermentation under different conditions.

It was found that mangold must contains all the nutrients necessary for good fermentation, and that when added to apple must, which is deficient in nitrogen, it gave rise to complete fermentation.

Among cider yeasts some, round, oval, more or less long, are very active, and others, the *apiculated yeasts*, which are lemon-shaped, have a weak fermenting capacity (1). Acids have a very harmful effect on the first type, whereas the second type can stand their addition even in large

(1) The differentiation between the yeasts of cider was made in 1800 by Mr. KAYSER. — G. WARCOLLIER, *Pomologie et cidricerie*, Paris, Baillière, 1909. (Ed.)

quantities, but, under their influence, they are gradually transformed, and change their characteristic form for an oval or round one, at the same time collecting together in groups.

It was also noted that apiculated yeasts, though rare at the beginning of the season, occur in abundance in late apples.

As the diffusion of the mangolds requires the use of sulphuric acid when the must of the mangolds is mixed with that of the apples, this sulphuric acid acts on the yeasts, thus diminishing the action of the vigorous yeasts and favouring the development of apiculated yeasts. The acid thus influences the fermentation products and gives rise to many volatile products (volatile acids and ethers).

The greater proportion of ethers found at the end of the season may therefore, be accounted for by the abundance of apiculated yeast and its resistance to sulphuric acid, the amount of which is usually increased at this time.

The temperature at which the musts are fermented also influences the volatile ethers which are produced in larger quantities at high temperature than at low ones.

When distilling a mixture of mangolds and apples, care should be taken not to add too large a proportion of sulphuric acid, and to use active yeasts, chosen amongst those which are most resistant to acidity, and to lower the fermentation temperature so as to eliminate, so far as possible the action of apiculated yeast.

669 - Simple Method for Estimating the Degree of Bolting of Wheat Flour. - PERRACINI, in *Le Stazioni Sperimentali Agricole Italiane*, Vol. L, Pts. 1-4-5, pp. 250-251, Modena, 1917.

The regulations laid down for the analysis of flour in controlling the degree of bolting necessitates important work not exempt from difficulties which can only be carried out in laboratories of agricultural chemistry.

For general commercial use the author has devised a simplified method which gives satisfactory results which are sufficiently exact to be considered as a good preliminary test.

The method, which is the result of many experiments, is as follows:

The necessary apparatus consists of:

- a) a control sample of 85 % flour;
- b) two or three receptacles of uniform shape and capacity, of transparent, thin and very clean glass;
- c) a 1 % solution of copper sulphate (= 99 to 99.5 % pure).

5 gr. of the 85 % control sample are weighed out and 5 gr. of the sample under examination, and the two flours put into separate receptacles. Equal quantities of copper sulphate are then added to the two flours which are rapidly shaken. The solutions are then left to stand with the matter in suspension; after 2 hours they are again shaken, and the flour then left to settle completely, which it does in 24 to 36 hours. If the solution of the flour to be tested is greener than that of the control flour it proves that the former contains more than 85 % flour. If on the other hand, it is of a bluish colour, it contains less than 85 %

inally, if the two solutions are of the same colour the bolting degree is the same. With practice the colour can be judged a few hours after the experiment has been started, but it is preferable to wait 2 or 3 days to be sure of the exactitude of the result.

By this method it is also possible to verify degrees of bolting superior or inferior to 85 %. All that is necessary is that the degree of the control flour be varied and this may be done even for 90 % flours.

The solution becomes greener in proportion as the amount of bran in the flour is greater; fine flour, without any trace of bran, shows a distinct blue colour, pure bran, on the contrary, gives a yellowish green colour.

In a note published in the same number of the *Stazioni Sperimentali*, Prof. LO PRIORE points out that, in using colorimetric methods, a careful examination of the action of a 1 % copper solution on flour showed that 185 % flours do not give the same colour. This depends on the quality of the wheat and the fineness of the pigmented layer of the pericarp after grinding. The reaction described by the author is, therefore, rather colorimetric than colorimetric, and is more suitable for use as a preliminary test giving an approximate indication than as a rapid and reliable quantitative determination. Prof. LO PRIORE, in the same note, discusses the colorimetric quantitative determination of pentosans in flour (TESTONI's method), and gives a bibliography of the most recent works on this question.

5 - **Quality of the Flour from Wheat grown in Dry or Irrigated Soils.** — See No. 632 of this Bulletin.

6 - **Sorghum Flour for Human Consumption: Investigations on its Digestibility.** — See No. 633 of this Bulletin.

7 - **Composition of the Juice of Hungarian Strawberries.** — SOMOGYI, MICHAEL and WEISER, STEPHAN (Communication from the Royal Station of Animal Physiology at Budapest), in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 32, Part 9, pp. 408-411, Münster i. W., Nov. 1, 1916.

The forests of the Carpathians produce enormous quantities of strawberries; in good years Hungary is capable of exporting the crude juice. In 1912, the amount exported was 4650 quintals (1 quintal = nearly 2 cwt.) chiefly to Germany. It is therefore interesting to know the composition of this juice. The writer has analysed 8 samples of unfermented juice, 17 samples of crude fermented juice, and 7 samples of juice obtained by a second pression with addition of water. The results of these analyses are given in the accompanying table.

These results show that the crude unfermented juice contains notable quantities of saccharose. The same thing has been noticed by JOULIN and CANU for French strawberries (2.01 %), whilst there are no data for German strawberries from this point of view. American strawberries also contain saccharose (0.80 %).

The juice obtained by a second pression had almost the same colour, odour and taste as the crude juice of more inferior quality. Its taste however has more often a slight resemblance to that of acetic acid, even when the content of volatile acid is not in excess of that of normal juices.

Composition of various juices of *Hungarian strawberries*.

Juice and composition	Specific weight at 15°C	grams in 100 cc.										Total acidity	Free acids	Volatile acids	Alkalinity of ash
		Dry matter	Invert sugar	Saccharose	Total sugar	Residue devoid of sugar	Ash	Nitrogen	Alcohol	cc. of normal soda per 100 cc. of juice.	per 100 cc. of juice				
Unfermented juice	average . . .	14.26	8.65	1.04	9.69	4.59	0.488	0.055	—	—	—	22.78	—	—	6.62
	minimum . . .	12.53	7.27	0.55	8.44	3.87	0.377	0.019	—	—	—	23.15	—	—	4.97
	maximum . . .	16.02	10.50	1.62	12.12	5.31	0.691	0.105	—	—	—	33.98	—	—	9.35
Fermented juice.	average . . .	4.80	0.55	0.05	0.60	4.20	0.519	0.019	1.99	27.49	—	—	3.55	—	6.87
	minimum . . .	4.37	0.40	0	0.40	3.74	0.412	0.010	1.44	24.02	—	—	2.49	—	5.70
	maximum . . .	5.40	0.63	0.30	0.66	4.76	0.564	0.028	2.55	31.27	—	—	6.00	—	7.80
Juice obtained from 2nd press, also with added water.	average . . .	3.95	0.44	0.05	0.49	3.46	0.407	0.022	1.35	22.09	—	—	3.61	—	5.42
	minimum . . .	3.28	0.35	0.02	0.39	2.83	0.360	0.015	1.01	20.07	—	—	2.54	—	4.75
	maximum . . .	5.30	0.71	0.07	0.78	4.52	0.506	0.028	1.66	30.23	—	—	6.47	—	7.90

673 - **Oil from Plum Stones.** — See No. 639 of this *Bulletin*.

674 - **On the Interpretation of the Results of Analysis of Tomato Preserve.** — GUARNIERI, P., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. L, Parts 3-4-5, pp. 245-249 Modena, 1917.

The writer enumerates the methods of analysis of tomato preserves; these include the determination of the following direct or relative values: dry extract — total ash — insoluble ash — alkalinity of the ash — density of the soluble portion — volatile acidity — total acidity — levulose — saccharimetric deviation — fibre — nitrogenous matter — matter containing phosphorous — potash — sodium chloride — oxalic acid; and the absolute values obtained by relating the relative values to 100 parts of dry extract (by multiplying the direct values by the constant coefficient for each preserve, this latter being the result of dividing the number 100 by the number representing the dry extract devoid of salt). He then develops the following considerations on the interpretation of the analytic results.

DRY EXTRACT. — The dry extract, devoid of salt, is sufficient of itself to give the degree of concentration of a normal preserve; considered in relation to its levulose content, it gives a prompt method of determining whether the preserve is made from fully ripe or unripe tomatoes, or even from tomatoes which have already undergone an appreciable amount of fermentation.

INSOLUBLE ASH. — A high insoluble ash content is an obvious sign of the use of tomatoes soiled with earth.

DENSITY OF THE SOLUBLE PORTION OF THE PRESERVE. — The relationship between increase of density due to the soluble substances of the preserve (properly corrected for salt) and increase of density observed in an aqueous solution containing the same percentage of levulose as the actual preserve, leads to the estimation based upon the ratio extract: levulose.

VOLATILE ACIDS. — Abnormal volatile acidity is a sign of deterioration.

FIXED ACIDS. — The relationship between fixed acids and the potash is an excellent piece of data for revealing the degree of maturity of the fruit in the preserve. The relationship is slighter the riper the fruit employed, since, as is already known, fruit with acid juice loses acidity as it ripens, owing to fixation of the potash. A high absolute fixed acid content is usually a sign of unripe tomatoes or of the addition of fixed acids, whether organic or mineral. It must also be borne in mind that the fixed acid content may also increase as the result of a degradation process of the carbohydrates. The acidity in ripe tomatoes is due to acid salts, the addition of fixed acids to the preserve is thus revealed by a comparison of the fixed acid content of the solution with the alkalinity of the ash.

LEVULOSE. — A feeble proportion of levulose is a sign of unripe tomatoes or of fermentation.

SACCHARIMETRIC DEVIATION. — A levorotatory deviation below the normal is a sign of either unripe tomatoes, fermentation, or the addition of glucose.

FIBRE. — An abnormal content is a sign of the use of unripe tomatoes or of careless preparation, resulting in the occurrence of skins and seeds in the preserve.

NITROGENOUS SUBSTANCES AND SUBSTANCES CONTAINING PHOSPHOROUS. — A high content of these substances means a preserve of good nutritive quality; the former on account of their high coefficient of digestibility, the latter as proof of richness in lecithin. A content of nitrogenous substances inferior to the limit is a sign of a preserve prepared with imperfectly ripe fruit, since it is common knowledge that a marked increase of these substances occurs during the last period of maturation.

POTASH. — A high potash content, while a sign of very ripe tomatoes, is a means highly recommended for estimating the value of tomato preserves.

OXALIC ACID. — The percentage of this acid is a valuable criterion for judging the state of maturation of the tomatoes employed.

675 — **Effects of Feeding Cottonseed Products on the Composition and Properties of Butter.** — See No. 651 of this Bulletin.

676 — **Pepsin in Cheesemaking.** — STEPHENSON, C., in the *Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XIV, No. 1, pp. 32-33, Wellington, January 20, 1917.

The present shortage of rennet is a serious menace to the New Zealand cheese industry. Experiments in the use of pepsin as a total or partial substitute for rennet were, therefore, made by the Dairy Division. The results obtained were entirely satisfactory.

In order to make a thorough comparison between the action of the pepsin and that of the rennet, the same class of milk was used in each experiment.

As soon as the milk reached the factory it was divided equally and poured into 3 vats. The milk in vat No. 1 was coagulated with pepsin, that in vat No. 2 with a mixture of pepsin and rennet, and that in vat No. 3 with rennet only. The pepsin was used at the rate of 2 $\frac{1}{2}$ drams per 1000 lbs. milk, and the rennet at the rate of 3 $\frac{1}{2}$ oz. per 1000 lbs. milk.

The curd in vats 2 and 3 was ready for cutting in 30 minutes, while that in vat 1, in which pepsin only was used, required 10 minutes longer before it was firm enough for cutting. No difference in the development of acidity was observed between the curds of any of the vats. The weight of cheese from each vat was practically the same.

The whey in vat No. 1, coagulated with pepsin, had a rather lower fat content than that of vats No. 2 and 3. This may be attributed to the slowness of the coagulation. This experiment, as well as later tests, shows that the action of pepsin when used alone is somewhat slow, even if it is added in larger quantities.

For this reason a mixture of pepsin and rennet is strongly recommended. Before being added to the rennet, the pepsin should be dissolved in 20 times its own weight of water; the mixture should then be diluted with

about half a bucketful of cold water before being stirred into the milk. If warm water is used its temperature should not be above 100° to 105° F. as the pepsin will, in this case, quickly lose its strength. Pepsin solution kept for any length of time becomes so weak as to be practically useless, and should always be prepared afresh 15 to 20 minutes before use.

The present price of pepsin is 18 s. to 19s. per pound, and that of rennet £ 3 to £ 3.5 s. per gallon. As 1 lb. of pepsin is practically equal to 1 gallon of rennet, its use presents distinct economic advantages.

The cheeses made with pepsin were of good quality, and no difference could be observed between them and those coagulated with rennet.

77 - **Preservation of Timber.** — *The Colonial Journal*, Vol. 10, No. 4, pp. 306-308. London, April, 1917.

The sap which exists in the cells and vessels is the chief cause of the decay of timber, especially that which is put in the ground.

A brief survey of the processes used to preserve timbers is given. Special attention should be called to a new method, called "Powellising". By this method the green timber is placed in a bath containing a substance with a boiling point well above that of water, for example, molasses. This is heated till the molasses is hot enough to boil off the moisture in the green timber. The bath is then allowed to cool. If white arsenic be added, then the molasses absorbed impregnates the wood with this preservative when cooling.

PLANT DISEASES

GENERAL INFORMATION.

678 - Decree regarding the Organisation of the Phytopathological Service in Italy. - *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 144, p. 2832. Rome, June 19, 1917.

Under date of April 25, 1917 the Italian Minister of Agriculture issued the following decree which entered into force on June 20.

Art. 1. - The Phytopathological Service is maintained by the Regional Observatories of Phytopathology, the names and districts of which appear in the list appended to the present decree.

Art. 2. - The Royal Inspectors of Plant Diseases have the power to inspect, at any time or place, the work entrusted to the delegates for the control of plant diseases by the order of March 12, 1916, No. 723 (1). At the same time they are obliged at once to communicate the result of their inspection to the Director of the Regional Observatory of Phytopathology.

Art. 3. - The regional delegates for Phytopathology only possess powers of control in the area administered by the Observatory to which they are attached. At the same time, whenever they may happen to see outside their own area, plants or portions of plants on sale or being forwarded for the purpose of sale, infected by diseases rendering them liable to sequestration, it is their duty to have same confiscated by the local authorities, at the same time giving immediate information to the Director of the Observatory in order that further measures may be taken.

The following is the list of observatories accompanying the decree.

For the purpose of plant control Italy is divided into 21 districts. In each of these districts there will be either a special institute serving as regional observatory, or use will be made of another establishment already existing, with the aid of the necessary technical staff already attached to other agricultural institutions throughout the Realm.

1) TURIN: Royal observatory (autonomous) of Phytopathology, for the provinces of Turin, Novara and Cuneo;

2) CASALE MONFERRATO: Provincial observatory of Phytopathology for the province of Alessandria;

(1) See B. August 1913, No. 995.

- 3) MILAN: Laboratory of Plant Pathology of the Higher School of Agriculture, for the provinces of Milan, Como, Bergamo and Sondrio;
- 4) PAVIA: Royal Laboratory for Fungoid Diseases of Plants, for the provinces of Pavia, Cremona, Brescia, Piacenza and Parma.
- 5) COMBOLIANO: Natural Science Laboratory of the Royal School of Viticulture, for the provinces of Udine, Belluno, Treviso, Padua and Venice.
- 6) ROVIGO: Royal Experiment Station for Beet cultivation.
- 7) REGGIO EMILIA: Natural Science Laboratory of the Royal School of Zootechny and bee-making for the province of Reggio Emilia;
- 8) MODENA: Royal Agronomic Station, for the provinces of Modena and Mantua;
- 9) BOLOGNA: Laboratory of Plant Biology of the Royal University (Faculty of Agriculture), for the provinces of Ferrara, Bologna, Forlì and Ravenna;
- 10) VENTIMIGLIA: Royal office of Phytopathology, for the provinces of Porto Maurizio and Genoa.
- 11) FLORENCE: Royal Station of Agricultural Entomology, for the provinces of Massa and Carrara, Lucca, Florence, Pisa, Leghorn, Siena and Grosseto.
- 12) PERUGIA: Laboratory of Plant Pathology of the Royal Higher Institute of Agriculture, for the provinces of Perugia, Pesaro and Urbino, Ancona, Macerata and Ascoli Piceno;
- 13) ROME: Royal Station of Plant Pathology, for the provinces of Rome, Aquila, Teramo and Chieti;
- 14) AVELLINO: National Science Laboratory of the Royal School of Viticulture, for the provinces of Campobasso, Benevento and Avellino;
- 15) PORTICI: Laboratory of Agricultural Zoology of the Royal Higher School of Agriculture, for the provinces of Caserta, Naples, Salerno and Potenza;
- 16) BARI: Royal anti-phylloxera commission, for the provinces of Foggia, Bari and Lecce;
- 17) REGGIO DI CALABRIA: Royal Chair of Agriculture, for the provinces of Reggio and Catanzaro;
- 18) PALERMO: Royal Institute of Colonial Botany, for the provinces of Palermo, Trapani and Girgenti;
- 19) ACIREALE: Royal Station for Citrus Culture (R. Stazione di Agrumicoltura), for the provinces of Messina and Caltanissetta, and for the districts of Acireale, Nicosia and Caltagirone.
- 20) CATANIA: Natural Science Laboratory of the Royal School of Viticulture, for the district of Catania and the province of Syracuse.
- 21) CAGLIARI: Natural Science Laboratory of the Royal School of Viticulture, for the provinces of Cagliari and Sassari.

79. Decree by the Minister of Agriculture, in Italy, Regulating the Importation of Living Plants, Portions of Plants, Seeds and other Plant Products. — *Gazzetta ufficiale del Regno d'Italia*, Year 1917, No. 111, p. 2379. Rome, May 11, 1917.

In view of the necessity of preventing the introduction of exotic diseases which might totally destroy certain home crops:

- 1) "black rot" of the grape (*Guegnardia Bidwellii*); 2) "ink disease" of chestnut (*Enkelia parasitica*); 3) "corky scab of potato" (*Spongospora Scabiei*); 4) "black scab of potato" (*Sclerotium endobuticum*); 5) exotic dodders; 6) "potato leaf-curl"; 7) San José scale (*Aspidiotus perniciosus*); 8) "citrus scale" (*Lepidosaphes gloverii*); 9) Potato Tineid (*Lia solanella*); and 11) American Coleoptera attacking the potato (*Doriphora decemlineata* and *Epicauta cucumeris*).

and to prevent the introduction into the realm of other unforeseen diseases by means of soil or seeds, the Minister of Agriculture, under date April 25, 1917, has published the following decree which entered into force May 12, 1917:

Art. 1. — The importation from abroad of living plants, portions of plants, seeds and other plant products intended for cultivation or reproduction, can take place through the Customs houses at Milan, Turin, Ventimiglia, Genoa, Rome, Naples, Catania, Palermo, Cagliari.

Art. 2. — Parcels containing the above products, presented at other Customs Houses, are to be refused. They can, however, be re-forwarded to the nearest Customs mentioned in art. 1, provided the senders, express to the Customs officials their readiness to pay the necessary expenses for same.

Art. 3. — The above mentioned parcels on arrival at one of the Customs listed in Art. 1, are allowed to enter the country after examination by a special delegate for Phytopathology, nominated by the Minister of Agriculture to the local customs authority in conformity with Art. 18 of the Order of March 12, 1916, No. 723.

Art. 4. — Whenever a parcel is allowed to be imported, the contents are subjected by the delegate to the precautionary measures anticipated by articles 18, 20 and 21 of the Order of March 12, 1916, No. 723.

Art. 5. — Citrus plants and portions of same, except the fruits, of whatever origin, certified by the delegate as free from any of the diseases enumerated above or any of the local diseases entailing sequestration, are allowed to enter, but must first, in virtue of art. 20 of the Order of March 12, 1916, No. 723, be submitted to quarantine.

Art. 6. — The measures noted in art. 5 are applicable to all fruit plants or portions of same, except fruits from Canada, United States of America, Chili, Hawaiian Islands, Japan, China, Australia and Germany.

Art. 7. — Seeds for reproduction must first be disinfected under the care of the delegate for phytopathology in accordance with instructions from the Ministry of Agriculture.

Art. 8. — Seeds of forage plants are allowed entrance after examination has shown the absence of dodder.

The statement of purity is given by the special delegate or by a Government laboratory entrusted with the work of control.

Art. 9. — Importation of the following plants or parts of same is suspended.

- a) cuttings and rooted cuttings from European or American vines, from France, Spain, United States and Canada; existing antiphyllloxera measures remaining valid;
- b) seedlings, bark and branches with bark of chestnut from the United States.
- c) fresh fruit of any kind from the following countries: Canada, United States, Chili, Hawaii, Japan, China, Australia, Germany;
- d) citrus fruits from all foreign countries.
- e) potato tubers from all foreign countries.

Art. 10. — Vegetable products for food purposes and for manufacture, except those mentioned in art. 9, are allowed to be imported through any customs in the kingdom, the measures prescribed by art. 17 of the order still remaining in force.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

10 - **Bacteria and Fungi Parasitic on Cultivated Plants, Observed in 1915 in the Province of Turin and Neighbourhood** (1). — VOGLINO, PIETRO, in *Annali della R. Accademia di Agricoltura di Torino*, Vol. LIX (1916), pp. 251-263. Turin, 1917.

The writer enumerates over 70 plant parasites, the majority of which are fungi.

The following merit particular notice: 1) disease on the trunk of *Celtis australis*, observed at Nole Canavese, from which were isolated a few bacterial forms, apparently the cause of the trouble; 2) a bacteriosis of the pepper plant, in which the bacterium isolated is distinct from the *Bacillus solanacearum*; 3) the value again demonstrated of sprayings with a 1% mixture copper sulphate and lime, repeated at intervals, on pepper seedlings in hot beds, before transplanting, as a preventive of *Phytophthora lactorum*; 4) the disastrous and almost general development of *Plasmopara viticola*, due to atmospheric conditions and absence of preventive treatment; in early July, only those bunches were healthy that were protected from the rain, e. g. those of vines occurring under the verandahs of country houses. The same thing was noticed even in places where no treatment had been given. On the bunches of "Isabella" stocks, which were badly attacked by the disease, the conidia measured $26 \cdot 30 \times 14 \cdot 16 - 18 \mu$, rarely $20 - 26 \times 14 - 16 \mu$; on the leaves of native vines the largest conidia did not exceed $14 \times 14 \mu$ with an average of $18 - 20 \times 12 \mu$; upon a tendril of an Isabella vine the conidia were 22μ long and 14μ broad. The *Plasmopara* infection, in the first 10 days of July, had destroyed 50 to 60% of the bunches. Damage was checked to a large extent by treatment with sulphur mixed with copper sulphate and gypsum in the proportion of 7 parts of sulphur to 2 of copper sulphate and 1 of gypsum; 5) the appearance of *Herpotrichia nigra* on *Pinus austriaca*, in the Valentino park, Turin; 6) the value of careful spraying with "pasta Caffaro" or a 1% mixture of copper sulphate and lime, in order to limit the damage caused by *Ascochyta hortorum* to eggplants, tomatoes, etc.

11 - **Fungi of Portugal and Angola, Africa.** — DE SOUSA DA CAMARA, EMMANUELE, in *Ministerio de Fomento, Boletim da Direcção Geral da Agricultura*, Year 13, No. 3, pp. 1-29, plates I-III in colours. Lisbon 1916.

The fungi occurring most frequently on cultivated or useful plants in Portugal are as follows:

1) 4 species new to science: *Placosphaeria Almeidaiana*, on the stems of *Dahlia variabilis*, in the Coimbra Botanical Garden; *Sphaeropsis Bougainvilleae*, on the branches of *Bougainvillea spectabilis*, in the same locality; *Diplodia Traversiana*, on the leaves of *Myrica Rhacoma*, again in the same locality; *Rhabdospora Molleriana*, on the leaves of *Celtis australis*, near Coimbra, Cêra de S. Bento;

(1) See also *B.*, June 1915, No. 650.

2) Another form new to science: *Phoma Ilicis* Sacc. f. *Mygindae*, on branches of *Myginda Rhacoma*, in the Coimbra Botanical Garden;

3) 24 micromycetes not so far mentioned in the Portuguese list: *Puccinia Phragmitis* (Schum.) Körn., on leaves and stems of *Arundo Donax*, near Villa Franca de Xira; *Entyloma hieronense* Har. and Pat., on stems of *Poa* sp., in the garden of the Lisbon Agronomical Institute; *Physalospora pustulata* Sacc. on leaves and petioles of *Aucuba japonica*, in the Coimbra Botanical Garden; *Stigmalea lauricola* Rehm on branches of *Laurus nobilis*, near Coimbra, Cêrca de S. Bento; *Melasphaeria culmifida* (Karst.) Sacc. on stems of *Milium multiflorum*, in the same locality; *Massaria Aesculi* Tul., on branches of *Acer campestre* in the Coimbra Botanical Garden; *Cystopus Tragopogonis* (Pers.) Schr., on leaves of *Tragopogon* sp., in the garden of the Agronomic Institute of Lisbon; *Microphoma acaciaecola* Pat., on leaves of *Acacia* sp., near Cascais (Estoril); *M. Eriobotryae* Pegl., on leaves of *Eriobotrya japonica* near Parede (Cascais); *M. Penzance* Ferr., on bark of *Populus alba*, near Malveira (Tôres Vedras); *M. smilacina* on leaves of *Smilax aspera*, near Colares (Sintra); *Phoma insularis* Cke. and Mass., on leaves of *Aucuba japonica*, in the Botanical Garden of Coimbra; *Ph. Rosarum* Dur. and Mont., on branches of *Rosa m. schata*, near Coimbra; *Ph. Smilacis* Boy. and Jacq., on leaves of *Smil. aspera* near Colares; *Phyllosticta cicerina* Prill. and Del., on leaves of *Cit. arietinum*, near Vila Viçosa (Alentejo); *Coniothyrium Dasylii* Celotti, on leaves of *Dasylium acrotrichum*, in the Botanical Garden of Coimbra; *Diplodiella Goetheana* Trav., on leaves of *Chamerops humilis*, near Monchique (Algarve); *Hendersonia Oleae* (Speg.) Sacc. and Trott., on leaves of *Olea europaea*, near Castelo de Vide; *Septoria calycina* Kickx, on peduncles and calices of *Dianthus Caryophyllus*, near Cartaxo; *Colletotrichum Linum muthianum* (Sacc. and Magh.) Br. and Cav., on pods of *Phaseolus vulgaris* near Cascais (Quinta de Caparide); *Gloeosporium Spegazzinii* Sacc., on leaves of *Citrus Limonium*, near Vila Viçosa; *Gl. triviale* Speg., on leaves of *Crinum giganteum*, in the Botanical Garden of Coimbra; *Pestalotia lignicola* Cke., on leaves of pods of *Acacia* sp. and *A. melanoxylon*, near Coimbra, Cêrca de S. Bento; *P. strobilicola* Speg., on leaves of *Pin. Pineae*, near Trafaria.

There follows on the above a description of *Rabenhorstia Raphia* sp., observed on the petioles of *Raphia textilis*, near Landana (Angola) in association with *Phoma herbarum* West.

682 - Practical Means of Control of the "Oidium" of the Oak. — DANIEL, LORENZ. *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 164, No. 1 (June 18, 1917), pp. 957-959, Paris, 1917.

The experience of the writer, derived from his numerous observations in France on the "Oidium" of the oak, is that the development of the fungus and the relative intensity of the attack are in direct relationship with the state of health of each particular tree and with the method of management for the production of faggots.

On many farms the branches of oak are cut back every 7 years to the bare trunk and the crown removed, which results in the formation of clus-

ters of short branches. In other localities the tree is decapitated towards the middle, at heights which vary, and the trunks then resemble pollards.

These two processes radically destroy the normal balance of growth.

The root-system remaining intact, nutritive matter from the soil continues to be conveyed to the aerial portions of the plant; branches are formed which become covered with leaves, the object of which is to remove the excess of water in the tissues. The balance is only restored slowly, possibly several years being required. The result is that, until equilibrium has been re-established, the tissues of the oak contain a greater quantity of water than usual and the tree suffers from this excess in a greater degree the greater the relative difference in efficiency between the absorbent and the assimilating portions of the plant.

As a consequence, trees which have been newly cut back are attacked in a greater degree than those cut the preceding year and these latter are less resistant than those cut several years previously; finally, trees which have not been touched at all suffer least from the "oidium".

In view of the spread of the "oidium", the present system of management should be replaced by another which allows a certain number of branches to remain at the crown of the tree and which only involves cutting shoots issuing from the lower part of the trunk. The branches of the crown become covered with leaves as normally and draw the nutritive elements to this point, at the same time evaporating off the water.

In this way the balance of nutrition consequent on the cutting is less disturbed and, in addition, the crown of the tree, receiving more moisture, does not wither in the manner that occurs after removal of the crown and an attack of "oidium". Considerably less is to be feared from this latter as, owing to the lesser amount of water in its tissues, the tree makes a better resistance.

This method has been tested in various districts in the west of France and has given the results anticipated by theory. It is profitable to the farmer as bigger and better wood is obtained. Farmers hesitate to employ it, however, as it gives a somewhat smaller quantity of faggots. As this system constitutes the only practical method for combating the disease, its adoption should be rendered compulsory.

663 - Patents Relating to the Control of Diseases and Pests of Plants. — See No. 664 of this Bulletin.

684 - *Fusarium tracheiphilum* Parasitic on Soy-Bean (*Soja max*) in North Carolina. — CROMWELL, RICHARD O., in *Journal of Agricultural Research*, Vol. VIII, No. 11, pp. 431-440, Fig. 1. Pl. 95. Washington, D. C., March 12, 1917.

The description of a cryptogamic disease of *Soja max*. (L.) Piper (syn. *Glycine Soja* Sieb. and Zucc., *S. hispida* Moench, etc.) studied in 1915 and 1916 in North Carolina and popularly known as "bean blight" or "soy-bean wilt".

The disease is characterised by a chlorosis and shedding of the leaf or leaflets, followed by the death of the plants. It has been observed in several localities in North Carolina on soils infected with *Fusarium trachi-*

philum Smith which causes the disease of *Vigna sinensis* Hassk, commonly called "cowpea wilt".

Soy bean wilt is also due to a *Fusarium*, and cultural, as well as morphological studies have proved that the fungus which attacks soy-beans is identical with the organism producing wilt of *V. sinensis*.

Reciprocal inoculation experiments conducted in the greenhouse and under field conditions with the micromycete from soy beans and that from cowpeas shows the identity of the two *Fusarium*.

Infection probably occurs through the roots, but Nematodes do not seem to increase materially the percentage of diseased plants. The character of the soil appears to influence the percentage of infection, since the largest proportion of infected individuals appeared in coarse sandy soil.

685 - *Melanconium Sacchari*, the Cause of the "Rind Disease" of the Sugar Cane. — JOHNSTON, JOHN R., in *The Journal of the Board of Commissioners of Agriculture, Porto Rico*, Vol. I, No. 1, pp. 17-17, pl. I. San Juan, P. R. 1917.

The sugar cane disease known under the name of the "rind disease" has, as a result of investigations carried on during the last 20 years, been recorded from different parts of the world: the southern portion of the United States of America, Cuba, Jamaica, San-Domingo, Porto Rico (where, according to the writer, it is widespread), Barbados, British Guiana, St. Vincent, Antigua, Nevis, Argentine, Mauritius, British India, Tonquin, Java, Natal, Queensland, New South Wales and Hawaii (1).

The disease is caused by *Melanconium Sacchari*, a fungus having, as far as is known at present, only one spore-form in its life history.

The symptoms of the rind disease are eruptions on the rind of the cane from which protrude black masses of conidia, together with a drying up of the leaves.

M. Sacchari is a wound parasite, i. e. capable of infecting cane only through wounds produced by insects or other cause. It may be classed as an active parasite on certain weak, or soft, canes, such as Bourbon and "D. 116".

Treatment of the disease is restricted to the use of hardy varieties, to adopting such methods as will reduce the moth borer and to grinding the cane before it is over-ripe.

Two other species of *Melanconium* have been found on sugar-cane and are described: *M. saccharinum* and *M. Ilium* (2), but they cannot be regarded as the cause of "rind disease". A bibliography of 39 works is appended to the article.

686 - On the Causes of Root Rot of the Mulberry and Protective Measures in Piedmont, Italy. — VOGLINO, P., in *Informazioni Scritte*, Year IV, No. 5, pp. 97-100, Rome, March 5, 1917.

Owing to the serious damage caused by root rot of the mulberry in various parts of Piedmont, the Minister for Agriculture, on the proposal of

(1) See on this subject *B.* July 1911, No. 2357.

(2) See *B.* February, 1913, No. 187.

the Council for sericultural interests, has given to the author, Director of the Phytopathological Observatory of Turin, the task of studying, in 1914, 1915 and 1916, the causes of the disease and suitable measures to be used.

Observations on specimens obtained from various localities in Piedmont have shown that two fungi: *Armillaria mellea* Vahl and *Rosellinia necatrix* (R. Hartig) Berlese, were present on diseased mulberry trees.

The disease attacks both young, planted-out trees and trees up to 40 and more years old. *R. necatrix* was usually found on young, planted-out trees, as well as nursery plants.

Root rot produced by *A. mellea* shows four different stages in its attack: a) infection commences in autumn, the leaves yellowing partly in the following spring; in the second year, development is much restricted; in the third, the plant gradually declines more and more, dying in summer; b) the plant infected in autumn dies the following autumn; c) yellowing of leaves in spring and death of the plant in autumn; d) sudden death of a vigorous plant.

Sometimes the rot commences in the collar region, sometimes at the tip of the roots and even in the principal roots; in every case, it attacks three regions of the plant: collar, roots and trunk, the latter up to 20-30-60 cm. above the soil, according as the disease dates back 2 or more years. The disease causes the bark to become loose in the infected region and also causes other phenomena in the rotted wood.

In the collar-region there is abundant secretion of a yellowish liquid; in the root, between the cortical layers, a white, downy felt forms which continues in black, hard plates and in long, black rhizomorphs; on the trunk the bark, in falling off, leaves whitish and black scales.

The fructifications of *Armillaria* develop all round the dead plants after the rotting of the roots.

In 1914-15, in connection with the yellowish brown plates, small hard, dark, prominent growths were observed on the stems attacked by the rot. The growths at first contained pycnidia of *Cystosporina ludibunda*, Sacc., and, eight months later, perithecia of *Eutypa ludibunda*, Sacc. The hyphae, which form brown and white plates, destroy the cambium and part of the wood; they are in direct relation to the above-mentioned fructifications, and a sequence of the fungoid plates which ascend the collar from the point where the rot commences. Experiments are now being made to determine the action of *C. ludibunda*. At the present time *E. ludibunda* is known as a saprophyte of the branches and trunks of many trees, causing the cortical to separate easily from the wood.

The fructifications of the other fungus (*Rosellinia*) which causes the rotting of the root, have been found in the black growths (sclerotia) which emerge from the parts of the root which are already dead. These sclerotia give off conidiophores consisting of filaments, stiff and brown in the lower part, and light in the upper part; they show lateral, egg-shaped, colourless conidia.

The rot caused by *Rosellinia* only attacks the root. Damp surroundings and soil rich in fertilising matter favour the growth of the fungus. As

in the case of *Armillaria*, the first symptom of the disease is a yellowing of the leaves.

There is little doubt of the parasitic nature of the root rot, but it must not be forgotten that, each year, the mulberry is stripped of its leaves and closely pruned, thus being so weakened that the attacks of parasites are made easy.

When, at the period of its greatest strength, the leaves and branches are removed from the plant, the lack of equilibrium in the circulation of nutritive matter causes abnormal secretions, particularly round the collar, and, consequently, brings about conditions very favourable to the development of *Armillaria* hyphae, as a result of the rhizomorphs in the soil. If there is a very great lack of equilibrium the sap is largely absorbed by the mycelium of the fungus, the nutritive matter cannot reach the new leaves, and the plant invariably dies.

Rot of the roots is connected, not only with the systems of cultivation, but with certain favourable conditions of the soil in which the mulberry is planted. Usually soil, rich in organic matter and good from an agricultural point of view, favours the growth of the parasites; infection is also favoured by sandy or moist soils which are difficult to drain, and particularly by those with stagnant sub-soil water.

As root rot is contagious it is wisest to leave ground in which infected mulberry trees have died empty for at least two years, or to give it up entirely. It is well to tap the trees in spring by means of holes or longitudinal incisions, so as to remove the juices which the plant cannot absorb because of the recent removal of the leaves; the wounds should be treated with a 10 to 20 % ferrous sulfate solution. Siftings or small quantities of calcium cyanamide should be spread round the base of the tree.

Owing to the many circumstances which render the plant susceptible to root rot it is very difficult to fight the disease. Experiments on the subject are being carried out, but it will be impossible to obtain results for a few years.

It is necessary to increase the cultivation of mulberries as bushes, to form local nurseries and to practice rational annual pruning.

687 - *Phoma endogena* a Spheropsis Parasite of the Chestnut in Piedmont, Italy. — VOGLINO, P. and BONGI, V. in *Annali della R. Accademia d'Agricoltura* Vol. LX, 12 pp. 3 figs, 1 pl. Turin, 1917.

This is a preliminary note on a disease of chestnuts which, for some years past, has been observed on the hills near Turin. The pericarp of the achenes shortly after the completion of storage, becomes completely detached from the seed as the result of shrinkage of this latter, and shows a number of lumps and hollows. The embryonic axis turns brown, while the cotyledons retain their normal whitish colour but become extremely hard, as if calcified, and under pressure from a blade, break rather than allow themselves to be cut. In this state the chestnuts are extremely difficult to cook — boiling for 2 hours being insufficient — and, in addition, they acquire an unpleasant flavour which renders them almost inedible.

In chestnuts attacked by the disease removal of the pericarp and of the seed coat (easily performed) shows the cotyledons covered with a white coat caused by the matting together of the mycelial filaments, which are particularly abundant in the hollows and fill the small spaces and channels between the seed-coat and the cotyledons. On the raised portions of the cotyledons the investment formed by the hyphae becomes thinner and along the dorsal line may be completely absent, the dorsal line then often showing superficial brown patches. In the midst of the felted mycelium there occur numerous pycnidia, occasionally these are isolated but more frequently they are united into pseudostromatic formations, which, when completely formed, have the appearance of round corpuscles, reddish grey in colour when in process of formation.

These fructifications exist, not only on the surface of the cotyledons, but also constantly on the wall of the distinct cavity caused by the shrinking of the cotyledons. They also occur along the narrow channels which radiate from the centre of the cavity towards the periphery; on the other hand, they rarely develop on the seed-coat.

The pycnidia described above have been identified by the writers as those of *Phoma endogena*, a fungus discovered by SPEGAZZINI on ripe chestnuts at Conegliano (Venetia) and also observed later at Lyons, France.

Microscopic examination of sections cut in various places through the more or less internal portions of the cotyledons has demonstrated the parasitic nature of the fungus, the mycelium invading the whole of the cotyledon tissue.

The *Phoma* spores, grown at a temperature of 15-17° C. in drops of a sterilised decoction of chestnuts placed upon a glass slide or plated on gelatine, germinate very rapidly and give rise to a mycelium fructifying by means of pycnidia. Germination only proceeds very slowly in water and produces nothing else but a short mycelial filament.

Artificial infection of healthy chestnuts by means of the mycelium and spores of the fungus grown in a culture, has shown that infection occurs after dehiscence of the burr, especially along the little crevices which may occur in the pericarp, and particularly near the smooth apical zone of the fruit or in relation with the same. The fungus, however, has no destructive action on the pericarp.

WEEDS AND PARASITIC FLOWERING PLANTS.

688 - Observations on the Cause of the Noxious Effect of Weeds. — See No. 625 of this *Buildin*.

689 - *Centaurea solstitialis* and *Soliva sessilis*, Weeds of New South Wales (1). — MATTHEY, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part 3, pp. 181-184, 2 Coloured Plates. Sydney, March 1917.

A description of 2 Compositae: *Centaurea solstitialis* L. (St. Barnaby's Thistle) and *Soliva sessilis* Ruiz and Pav.

(1) See also *B. June* 1917, No. 606.

(Ed.)

The first of these plants is a native of Europe, North America and Western Asia. It has become extensively distributed in Australia, having been recorded from practically every State. In New South Wales, it has been reported as occurring in western localities such as Richmond and Bathurst, and in southern, such as Burrinjuck and Quacanbeyan. As a rule, it is looked upon as a weed and the advice is given to eradicate it when it is in flower.

S. sessilis, while a native of Chili, has spread extensively in other parts of South America, and also in California. It is now widely distributed in sub-tropical countries. It is impossible to say when this plant first came to Australia. New South Wales has had direct traffic with South America for many years and it is very likely that *S. sessilis* was introduced into the State more than half a century ago, either by imported animals, or through human agency.

When this plant is present in quantities, it is too costly to deal with, except in the case of valuable lawns. In such cases, it can be got rid of, partly by means of a sharp trowel, and partly by encouraging the growth of the grass by top dressing, or the use of a stimulant, as sulphate of ammonia, which will cause a heavy and smothering growth of grass.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

690 - **Invasions of Locusts in Uruguay, in 1915 and 1916.** — REPÚBLICA ORIENTAL DEL URUGUAY. MINISTERIO DE INDUSTRIAS, DEFENSA AGRÍCOLA. *Memoria de los trabajos realizados contra la langosta. Invasión del 1915-1916.* 1 vol. in-16, 444 pp., 39 maps, 28 figs. Montevideo, 1916.

A summary of the locust question in Uruguay, based on information supplied by the Government of that country, has already been given in the volume published by the International Institute of Agriculture (1).

The present report merely deals with the invasions of "langosta" which occurred in Uruguay in 1915-16 and which were more severe and more general than any hitherto known in the Republic.

The "Defensa Agrícola", thanks to information received from the Argentine predicting an early appearance of the pest in the country, was able to carry out in time propaganda and organisation work and to obtain all the help possible from private and official sources in view of the coming work of control. In 1915, an appeal was printed and distributed among the agricultural population, and also a publication containing practical instructions for fighting the locusts. Postcards were also distributed for collecting information as to the route followed by the insects and the state of development of the "langosta". An appeal was made for the help of public authorities, of the army, the railway companies, in order to augment

(1) See: *La lutte contre les sauterelles dans les divers pays.* Rome 1916, *passim* (B. Jan. 1917, No. 105). (Ed.)

the permanent staff of the "Defensa Agrícola". Commissions were formed throughout the republic in order to direct the work of control.

Winged swarms, coming in 1915 from the Argentine and Brazil, invaded the northern provinces and those along the Uruguayan littoral, whence they gradually spread throughout the country until not a single district remained which had not suffered in a greater or less degree. The general direction taken by the locusts was from north-west and north to south-west and south. The first province invaded was Artigas (August 19) and the last, Montevideo (November 25).

Owing to the continuance of the hot, dry weather, these invasions were followed by others, in 1916, coming from the Argentine. These latter lasted from March 25 to May 27, a thing so far unknown in "langosta" invasions. The provinces particularly visited in 1916 were Paysandú, Artigas, Salto, Soriano, Flores, Durazno and Florida.

On their arrival in Uruguay the locusts which, generally speaking, were little troubled by disease or parasites, deposited their eggs chiefly by the banks of streams; in many cases, however, probably on account of the size of the swarms, the eggs were laid in fields. Owing to the extraordinary development of the larvae ("mosquita" and "saltona" according to the state of development) it was very difficult to have recourse to expedients and to obtain really satisfactory results everywhere.

The material for the campaign of control at the service of the "Defensa Agrícola" having proved insufficient, it was necessary to make important purchases of raw materials on the Buenos Aires market; further, 140 workmen were employed at the Sayago depôt on the careful preparation of the material which was then impartially distributed by the "Defensa Agrícola" throughout the various provinces.

Instruments known as "látigos" proved particularly efficient against locusts at breeding time; cloths, etc. were also employed. The "látigos" are formed of a metallic net fixed to a wooden grip, the insects then being struck as by a broom; 18000 "látigos" were employed in the 1915-16 campaign. However, the destruction of locusts during copulation, however easy, is not generally adopted. In many parts of Soriano, Colonia, Paysandú and Salto, good results have been obtained by collecting the eggs.

The special blow-lamps ("máquinas a fuego"), of which 7835 were employed by the "Defensa Agrícola", have proved the most efficient for the destruction of the insect in the "mosquita" state. They work by ejecting naphtha which ignites on leaving the nozzle. The "Defensa Agrícola" has distributed 20 000 tins of combustible.

Metallic fences are acknowledged to be indispensable against the "saltona".

The method of control most employed in the 1915-16 campaign was that of fences and ditches. This is at once the most effective and most economical method of campaign; 550 000 metres of fencing have been prepared.

Various new apparatus and modifications of old systems have been examined by the "Defensa agrícola".

With regard to the various insecticides tested against the "mosquita"

the best results have been given by an emulsion of petrol in water and by a 8-10 % solution of potash in water.

Treatments based on molasses and arsenic, so much employed in Africa and elsewhere, have also been tested in Uruguay but so far not in sufficiently conclusive a manner.

It is worth noting that, in the departments of Montevideo and Canelones, where the campaign has been carried out right from the start in a regular manner with the cooperation of all concerned, the damage done to crops has been negligible.

The 1915-16 campaign involved an expense of 226 745 "pesos".

691 - *Prospaltella Berlese* against *Diaspis pentagona*. Observations in Piedmont during 1916 (1). — VOGLINO, P., in R. Osservatorio di Fitopatologia di Torino (Autonomo), Relazione del Direttore, 11 pp. Turin, 1917.

The observatory of Phytopathology of Turin in cooperation with the « Associazione serica e bacologica del Piemonte » has continued the work of control of *Diaspis pentagona* by means of *Prospaltella berlesii*. The work has been directly commissioned by the Government.

In March, under the supervision of the observatory staff, 115 745 branches covered with *Prospaltella* were distributed among the provinces of Turin, Coni, Alexandria and other localities.

The following June, the writer, who is Director of the Observatory, began an inspection of the mulberries in order to establish to what extent the *Prospaltella* had spread through Piedmont and whether it was advisable to increase its numbers. As usual, the degree of "prospaltisation" was observed in relation with the *Diaspis* infection, while taking into account the age of the infected branches and the general conditions of the mulberry trees. Samples were taken from various localities and sent to the observatory for examination.

The following conclusions are made :

- 1) Generally speaking, a new invasion of *Diaspis* may be said to have taken place in 1916 throughout the whole of the region in question.
- 2) there is, however, no need for alarm at the frequent reappearance of this scale-insect in Piedmont, nor to doubt the good effects of the *Prospaltella* ; if the *Diaspis* has again occurred in considerable numbers, the reason is to be found in the particularly favourable conditions for development occurring in 1916 ; there are grounds for hoping that next year will show an improvement, as the laboratory examination of the mulberry branches from the different parts of Piedmont has shown the invariable presence of the *Prospaltella* ;
- 3) this latter, while making a strong attack on the *Diaspis*, can never destroy it completely, nevertheless it is undeniable that the *Prospaltella* has rendered and will continue to render, the greatest service to mulberry cultivation ;
- 4) the mulberry trees found to be most often infected, even in zones

(1) See also B. June 1916, No. 707.

less severely attacked by the *Diaspis*, are those of bushy growth, with big branches in neglected condition; on these same trees the older branches and those covered with lichen are the worst attacked, the reason being that the *Diaspis* finds conditions favourable to development while the *Prospaltella* finds difficulty in depositing its eggs. The farmer should, therefore, keep his mulberries clean by careful pruning at close intervals or by cutting the branches back every two or three years;

5) artificial dissemination of the *Prospaltella* has been recognised as necessary in various localities of several provinces;

6) notwithstanding that, owing to the conditions favourable to development, the *Diaspis* was present everywhere in very considerable numbers, the mulberries still gave a good crop of leaves. This is due to the fact that, nearly everywhere, the majority of female scale-insects contained individuals of *Prospaltella*; in the localities (Stupinigi, Carmagnola, borders of the Dora Riparia, Saluggia) where in previous years the mulberries had been improved or almost entirely freed of the pest by means of the *Prospaltella*, in 1916 the *Diaspis* infection was restricted, this proves that the *Prospaltella*, properly distributed, had opposed excessive development of the scale;

7) *Chilocorus bipustulatus* proved to be very effective in 1916, thus aiding the action of the *Prospaltella*.

692 - *Contarinia tritici*, a Dipteran Injurious to Wheat and Barley in Sweden.

— 1) ÅKERMAN, A., in *Sveriges Utvædesförordnings Tidsskrift*, Year XXVII, Part I, pp. 24-33

2) TEDIN, HANS, *Idem*, pp. 34-42. Malmö, 1917.

1. — During the summer of 1916, the larvae of *Contarinia tritici* did considerable damage to the different varieties of wheat cultivated at Svalöf. The dipteran deposits its eggs in the flowers of wheat and other cereals immediately after they have come into ear. The damage so produced varies from 5 to 10 % of the yield of grain and, in exceptional cases, may even exceed 60 %, as actually occurred on a farm at Allerum (Scania). The varieties attacked were all bearded; careful examination of the crops, however, does not permit of the conclusion that the beardless varieties are less subject to attack by *Contarinia*. From this point of view a much more important factor is earliness: the varieties which had suffered most, viz. "Svenskt Sammel" (33.5 % of the yield of grain), "o 823 Pudel x Sv. Sammel" (15.5 %), "Thule II" (18 %), had earred on the following respective dates, 27th., 28th., and 29th. June; the varieties which suffered least, viz. "Smaahvede x Sol" (2.2 %) "Fylgia" (2.9 %), "o 865 Smaahvede x Extra Sq. II" (2.4 %), came into ear some days later, from the 1st. to 3rd. July).

2. — TEDIN has obtained exactly similar results in an investigation of the damage done by the larvae of *Contarinia* in barley fields at Svalöf and other parts of Sweden. In this case also it was the earliest varieties that suffered the most from the larvae. This does not mean that the late varieties have a higher specific resistance; the phenomenon is simply due to the fact that the females of *Contarinia* are more numerous in June than in the following season; in other conditions of temperature and moisture (annual variations) exactly the opposite state of affairs might occur.

693 - *Coeliodes fuliginosus*, a Coleopteron Injurious to the Poppy, in Austria.
— RANNINGER, RUDOLF, in *Zeitschrift für angewandte Entomologie*, Vol. 3, Part 3,
pp. 383-387, Berlin, December, 1916.

Very little is known about the Coleopteron *Coeliodes fuliginosus* Marsh., from the biological point of view nor do we possess any knowledge of practical methods of control. As a result of numerous experiments, the writer is now able to supply some useful information.

He has noticed that, at the end of May and beginning of June, numerous plants in a plantation of poppies had turned yellow and subsequently died. When the plants were pulled up the larva of the above Coleopteron was found on the roots; this latter is white with a brown head, legless, and 3-4 mm. long; microscopic examination shows the back to be covered with fine hairs. The larva gnaws the root and hollows out either round holes or open galleries 1 - 1.5 mm. in depth; it is generally found on the upper half of the root, sometimes down to a depth of 8 cm. beneath the soil. One plant does not usually harbour more than a single larva; occasionally two occur and rarely three. According to the writer, 60% of the plants harbour one larva, 38 % harbour two and 2 % contain three larvae.

The plants harbouring the larvae show a blackening of the roots from top to bottom, the leaves then turn yellow and later brown in the same way and eventually die.

At the beginning of July, the larvae were very scarce, there was nothing to be seen beyond the damage caused by them; the last larva was found on July 22. After the larvae have disappeared, the holes or galleries on the roots close up.

The adult insect devours the young leaves of newly thinned poppies. The plant shrivels and the plantation becomes undesirably thin.

All the strains of poppy examined by the writer were not similarly attacked by the insect which apparently prefers young and juicy plants.

The Coleopteron disappears relatively early so the damage caused is not great. The question as to the possibility of procuring immune strains is now being investigated.

According to the Station for Plant Diseases at Vienna, to which the writer submitted some specimens, there is only one generation in the year. The larva pupates in July, the perfect insect appearing 4 weeks later (late August to early September); the adult lives on various plants and hibernates in the soil, which it quits again in April.

As regards control, farmers have so far been content with pulling up and burning the plants considered to be attacked. As, however, it is almost impossible to distinguish those which harbour larvae from those which do not, the writer recommends the abandonment of this method. Nor is autumn ploughing to be recommended. Mineral fertilisers may be useful, however, by strengthening the plants. Prevention is best, though, and the writer recommends the following measures:

1) The poppies should be planted sufficiently widely apart to allow for proper developments.

2) By giving a dressing with Chili saltpetre or nitrate of lime, either

when thinning or immediately beforehand, the plant makes such strong growth that the attack of the insect remains without effect, calcium cyanamide or sulphate of ammonia can also be given; an application of potash-wood ash) is equally good and strengthens the plant well.

3) The crop preceding the poppy should be well manured with farm-yard manure, but the poppy itself never.

4) The poppy fields should be kept properly clean of weeds and the plants hilled up, it is specially important to pull up the weeds at least once after the plants are above ground and the rows are visible), to harrow the fields twice (once before pulling up the weeds, and again after thinning), and to hill up the plants once (after the appearance of the first branches);

5) sowing should be carried out in good time in the spring.

94 - *Phytomyza flavicornis*, a Dipteron Injurious to the Milan Cabbage, in Lombardy. — DEL VECCHIO, C., in *Natura*, Vol. VIII, January to April, pp. 75-77, figs. 2, Milan, 1917.

During September, 1915, in the experimental field of the Royal Higher School of Agriculture of Milan, situated at Sesto S. Giovanni (Monza), a large proportion of the Milan cabbages of a big plantation (sown July of the same year) had their large reddish or yellow outer leaves and the small inner leaves almost entirely atrophied. Examination showed the roots of all to be attacked by the larva of a Dipteron which had only injured the outer portions.

During the second half of October, the larvae pupated in the soil. In the summer of 1916 the pupae collected had become perfect insects and the fly was identified by Prof. BEZZI as *Phytomyza flavicornis* FALL.

In the same field, the writer found several roots badly damaged by another Dipteron, *Chortophila brassicae* Bouché and frequently saw *Aphis brassicae* on the leaves of some of the plants.

The whole of the Milan cabbages, however without exception, were attacked by *Phyt. flavicornis*.

95 - *Aleurodicus destructor* a Rhyncote Pest of the Coconut, in the Philippines (1). — ZIMMER, J. T., in *The Philippine Agricultural Review*, Vol. IX, No. 4, p. 276. Manila 1916.

In June 1916, in the province of Zamboanga (Dept. of Mindanao and Sulu), an insect was observed upon the coconut palm which was destroying considerable part of the foliage and immature fruit.

The insect was identified as *Aleurodicus destructor* Quaintance, a somewhat rare Rhyncote, or one at any rate rarely recorded as injurious to the coconut. So far as is known, it is confined to the Philippines where the type species were collected in 1911 (Eastern Negros). Two years after the first record i. e. in 1913, it was observed in the Province of Misamis.

(1) See B., June 1912, No. 992.

696 - *Rhynchophorus ferrugineus*, a Coleopteron Injurious to the Coconut and other Palms in Ceylon. — HENRY, G. M. in *The Tropical Agriculturist, Journal of the Ceylon Agricultural Society*, Vol. XLV:1, No. 4, pp. 218-219, 1 plate. Peradeniya 1917.

Rhynchophorus ferrugineus, the coconut red weevil, is common throughout Ceylon, particularly wherever the coconut is grown. It probably attacks other palms, such as *Caryota urens* ("Kitul") and *Areca catechu*, but *Cocos nucifera* seems to be the favourite host. It has been noticed that freshly cut stems of *C. urens* have a strong attraction for this coleopteron.

The adult insect, apparently, does no damage. The eggs are deposited in any wounds which may happen to occur on the stem of the palm, especially where the sap has fermented. The holes bored in the plant by another coleopteron, *Oryctes rhinoceros*, are especially chosen by the *Rhynchophorus* to lay its eggs in. Immediately it has hatched the larva begins to burrow out the stem.

The life of the larva is probably a long one. Eventually it forms a cocoon and pupates within its own galleries, emerging after a period, the length of which is unknown.

The whole of the interior portion of the stem is often converted into a sort of soft pulp in which the larvae live and bore galleries in all directions. When this mass ferments it attracts other individuals of *Rhynchophorus* which lay eggs in their turn, in such a way that the combined action of all these insects quickly causes the death of the palm. Often there is no external evidence of attack, but on approaching the stem the presence of the larvae may be detected by the noise they make while piercing the galleries within.

So far no parasites or other insect enemies of *Rhynchophorus ferrugineus* have been found in Ceylon. The usual method of control is to remove all the infected portions of the plant with the contained larvae and to fill up the cavities so formed with tarred fibre. Experiments were made by injecting carbon bisulphide into the galleries but without sufficient effect, besides, it would be impossible to procure the requisite quantity of carbon bisulphide in Ceylon. It seems that good results should be obtained by trapping the adults with pieces of fermented stem of *C. urens*. The chief thing, however, is to keep the coconut plantations clean by removing and burning dead palms and by picking up from the ground all dead pieces of stem. Care should be taken to avoid damaging in any way the surface of the palm stems.

697 - Observations on the Vine Phylloxera in Bulgaria. — POROFF, METHUEN and JONKMOFF, DIMITER, in *Zeitschrift für angewandte Entomologie*, Vol. 3, Part 5, pp. 367-382, Berlin, December 1916.

The writers state that, in Bulgaria, vines cultivated around dwellings and climbing upon trees, walls and other supports are much more resistant to phylloxera than vines pruned and cultivated in the open. This method of cultivation is known as "asmas" and occurs throughout Bulgaria.

The vines are from 4-5 metres apart, the soil is never worked; as the roots of the vines sometimes encounter roads, pathways or walls, they are

obliged to penetrate deep into the soil where they develop well, pruning being restricted to superfluous shoots. In this way vines are obtained resembling trees, with exceedingly well developed crown and roots, with the main trunk 15-20 cms. in diameter and with a shade area of 25-30 square meters; they often live for 100 years.

In every Bulgarian town and village vines cultivated "en asmas" are completely resistant to phylloxera, notwithstanding their European origin. On the other hand, pruned vines near the "asmas" are mostly attacked by the insect.

This immunity is not a character inherent in the variety but is due to the method of cultivation which is very unfavourable to the phylloxera for the following reasons:

- 1) in the case of vines with a deep and strongly developed root system where the radicicolous insects can only live on the upper roots, the lower roots are sufficient to support the more or less normal life of a plant;
- 2) entrance of the gallicolous insects into the soil is more difficult when the ground is not periodically worked; working of the soil enormously favours the migration of the phylloxera;
- 3) by limiting pruning to the minimum, branches and leaves are formed which are very resistant to phylloxera.

In conclusion, the writers recommend the abandonment of present methods of cultivation (close planting, working the soil, pruning) where circumstances allow of the method above described. If it is wished to obtain vines resistant to phylloxera, they must be allowed to develop in free form. Where manuring is necessary it should be effected before the phylloxera have begun to migrate and followed subsequently by a thorough riddling of the earth in order to prevent the insect from effecting an entry.

18 - *Clytus (Plagionotus) arcuatus*, a Coleopteron Injurious to the Oak, in Germany. — ESCHERICH, K., in *Zeitschrift für angewandte Entomologie*, Vol. 3, Part 3, pp. 388-397. Berlin, December 1916.

For some time past the timber merchants of the Palatinate have been complaining of the damage done to oaks by insects. In May, 1916, the writer accompanied by the forester FRANTZ, paid a visit to the oak woods in question in order to examine and assess the damage caused in this way.

It was observed in a saw-mill of the Dahn forest district that the oak-trees felled in 1915 and stored in front of the building were badly attacked by an insect which was identified later as *Clytus arcuatus* L. It had bored long galleries beneath the bark which contained either larvae of different sizes or pupae. In the trunks of trees felled in 1916 the insect could not be found.

Later on, a visit was made to a wheelwright in the same district who was complaining of the numerous galleries the insects had bored in his wood. The oak wood on the premises had been felled in 1914-15; it was completely invaded by the *Clytus*, larvae, pupae and adults. The trunks contained no other enemies, except a few which sheltered the cocoons of a big ichneumon unidentified by the writer.

At the time of a second visit in September to the same place, the trunks

felled in 1914-15 had all been worked and there only remained those of 1915-1916 which had only been brought to the saw-mills during the summer. They were all more or less attacked by the *Clytus*.

The majority of the larvae had attained one half or three quarters of their full size, some of them had already penetrated the inner portion of the trunk.

Introduction into the inner portion of the trunk is quite independent of the size of the larvae. The pupae and adults were completely absent.

According to the wheelwright, the trees stored in the shade were much less attacked than those stored in full sunlight. This corresponds with the fact that the *Clytus* is particularly fond of the light.

Clytus arcuatus thus especially attacks felled timber, but, according to ECKSTEIN and FRANTZ, it also destroys standing wood, especially that of poorly developed trees.

Cl. arcuatus is one of the most terrible enemies of oaks in the Palatinate where its appearance is an absolute calamity. Its rapid increase in numbers is due principally to the fact that, in the Palatinate, the cut timber usually remains lying about for a long time, which favours the hatching of the larvae.

The natural enemies of *Cl. arcuatus* not being very numerous, too much importance should not be attached to them. Besides the ichneumonids already mentioned, the woodpecker devours the insect.

In order to avoid damage, the following points should be observed:

- a) remove sickly trees from the plantation ;
- b) remove trunks immediately after felling (end of April at latest) or, if that is impossible, store the trunks in the shade.

The writer recommends making a trial of whitewashing the felled trunks in order to prevent the insect from ovipositing. Removal of the bark is dear and injurious to the wood.

Study of the life-cycle of *Clytus arcuatus* is required.

